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Farm Organization for Beef Cattle Production in Southwestern Minnesota

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SOUTHWESTERN MINNESOTA has many characteristics favorable to the selection of beef cattle as a farm enterprise. For convenience in an elaboration of these characteristics, they are here grouped into the following classification: (1) kinds of crops grown, (2) location with reference to central markets, (3) size of farm, (4) labor supply, and (5) preference of many farmers for a beef-cattle type of farming.

KIND OF CROPS GROWN

The natural conditions of soil, topography, and climate in the 11 southwestern counties in Minnesota (fig. 1) have resulted in the growing of corn, oats, and barley as the leading crops (table 1). Sixty per cent of the farm land was used for these three crops in 1929 as compared with 48 per cent in west central, 42 per cent in south central, and 38 per cent in southeastern Minnesota (table 2). Corn is the principal crop in southwestern Minnesota. It was grown on 30 per cent of the farm land in 1929. Together, the acreage of oats and barley was approximately the same as that of corn. An additional 4 per cent of the farm land was used for wheat and flax. Thus the grains produced are largely feed grains, with a relatively high proportion of corn and barley, which are essentially fattening grains as contrasted with dairy or growing-ration grains.

A smaller proportion of the farm land in southwestern Minnesota is used for tame hay than in any other part of the state. An average of only 5.1 per cent of the farm acreage in the area was used for growing tame hay in 1929 (table 2). Alfalfa is the principal tame hay crop. It was grown on 53 per cent of the acreage in tame hay in 1929. But harvested yields of tame hay are low in southwestern Minnesota, lower than in any other major part of the state.[1] The yields of harvested hay in the area, no doubt, are lowered as a result of using the meadows for pasturing hogs and young stock before cutting. Frequently only one cutting is harvested for hay, the growth the rest of the year being pastured. Nevertheless, hay does not compete successfully with corn

[1] Minnesota Annual Crop and Livestock Statistics, 1929-1930. The five-year (1924-1928) average yields of the principal crops are reported on pages 28 to 37 for the state by districts and by counties.

and grain as a major use of land in southwestern Minnesota under present systems of management of the crop. A high percentage of farm land operated by tenants, ranging in 1935 from 51.4 per cent in Faribault County to 67.9 per cent in Pipestone County, tends to discourage the use of a crop that remains on the land more than one year.

Associated with the relatively high percentage of the farm land that is available for growing grain crops are areas within practically every farm which because of uneven topography or poor drainage must be used for pasture or wild-hay meadows. Approximately 17 per cent of the farm land in this area is used for pasture, of which about one half is classified by the census as nonplowable pasture. Much of the plowable pasture is a less desirable type of crop land than that in crops in 1929 and is used semi-permanently for bluegrass pasture. Wild hay is cut from about 4 per cent of the farm area. Practically every farm in this area has some wild-hay land.

Incidental to the production of the grain and hay crops, there are produced additional quantities of pasturage and rough feeds, such as cornstalks, straw, and aftermath in meadows, which must be converted into animal products to put them into a marketable form. The southwestern Minnesota farmer finds it to his advantage, therefore, to keep either cattle or sheep, or both, in order to utilize his unmarketable feeds. Cattle as a major enterprise ordinarily have a comparative advantage over sheep on the corn-belt farm unless the pasture or roughage is exceptionally low in quality. Sheep raising on a large scale in the corn belt is handicapped in too many ways to compete successfully with cattle.

LOCATION WITH REFERENCE TO MARKETS

Feed grains and marketable roughages produced supplementary to corn and small grain crops in the rotation are marketed more economically when fed to animals on the farms where grown. The saving in transportation charges on bulky feeds is an important item in this area, which is located far from central markets. It is because of the relatively long distance from this area to central markets that feed-grain prices are low there as compared with most other surplus grain areas. Converting marketable grains into equivalent values in livestock reduces their weight by at least 70 per cent.

SIZE OF FARMS

The land in southwestern Minnesota that is adapted to cropping is comparatively level and may be laid out into large fields. The use of labor-saving machinery for producing grain crops is feasible, and a relatively large number of acres of these crops

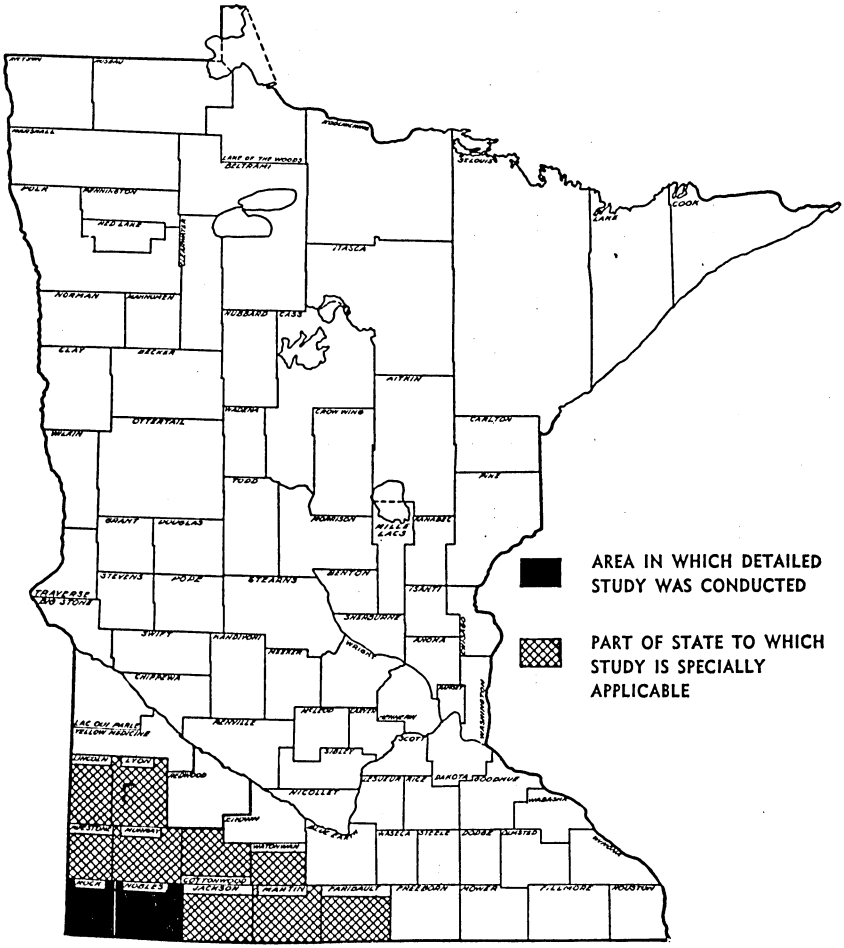

FIG. 1. LOCATION OF THE AREA STUDIED

A large proportion of the beef-cattle farms in Minnesota are located in the 11-county area shaded on the map. Although the discussion applies particularly to this area, it is equally applicable to farms outside this area that have similar characteristics.

Table 1. Percentage Distribution of Use of Land in Farms in Southwestern Minnesota, by Counties, 1929*

County	Crop												Pasture					
	Corn	Oats	Barley	Mixed grains	Wheat	Flax	Alfalfa, clover	Timothy and clover	Other tame hay	Wild hay	Other crops	Total crops	Plowable pasture	Woodland pasture	Other pasture	Total pasture	Other uses	Total
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Rock	34.6	24.1	8.4	0.8	0.1	1.0	3.3	0.9	0.3	3.8	1.4	78.7	9.2	0.2	8.0	17.4	3.9	100
Nobles	32.8	24.2	7.0	0.8	1.9	2.8	2.5	1.8	0.2	3.9	0.3	78.2	9.0	0.4	7.7	17.1	4.7	100
Jackson	30.3	21.2	7.7	0.8	2.0	3.4	3.0	2.4	0.6	4.3	0.8	76.4	10.3	1.0	6.1	17.4	6.2	100
Martin	33.2	23.8	5.6	0.7	1.7	1.5	3.7	1.9	0.2	2.9	2.1	77.3	10.8	1.2	5.3	17.3	5.4	100
Faribault	27.9	18.5	5.7	3.1	1.9	0.5	3.3	2.3	1.0	3.6	6.8	74.6	10.6	2.5	5.7	18.8	6.6	100
Pipestone	30.4	21.1	10.5	1.2	0.3	2.2	3.2	1.9	0.5	3.3	2.1	76.7	10.7	0.6	7.7	19.0	4.3	100
Murray	28.9	19.3	10.5	0.8	0.2	2.7	2.8	1.9	0.4	4.5	5.5	77.5	9.0	0.7	7.3	17.0	5.5	100
Cottonwood	28.5	19.1	10.5	0.6	1.5	3.5	3.3	1.3	0.4	5.1	3.3	77.1	7.7	0.7	8.3	16.7	6.2	100
Watonwan	29.4	19.1	5.3	1.2	1.5	2.7	3.8	2.1	0.2	5.8	2.8	73.9	11.0	1.6	7.5	20.1	6.0	100
Lincoln	23.5	15.3	10.3	4.8	1.7	3.8	3.7	1.7	0.6	4.7	5.6	75.7	7.5	0.9	8.9	17.3	7.0	100
Lyon	30.3	18.3	9.8	1.7	3.6	2.9	3.4	1.0	0.5	4.1	2.8	78.4	8.4	1.1	6.4	15.9	5.7	100
Average	30.0	20.4	8.3	1.5	1.5	2.5	3.3	1.7	0.4	4.2	3.0	76.8	9.5	1.0	7.1	17.6	5.6	100

* Fifteenth Census of the United States: 1930. Agriculture, Vol. II.

Table 2. Distribution of the Use of Land per Farm for Grains, Hay, and Pasture in Minnesota, by Districts, 1929*

District†	Average size of farms	Use of land									
		Corn	Oats	Barley	Wheat	Mixed grains	Tame hay	Wild hay	Plowable pasture	Woods pastured	Other pasture
	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Southwestern	200	60	40	17	3	3	10	8	19	2	14
West Central	202	38	32	20	17	7	11	14	16	5	12
South Central	146	31	15	6	9	10	11	10	11	8	19
Southeastern	163	22	18	12	3	10	21	1	18	21	13
Central	152	20	18	8	6	4	12	13	8	24	14
East Central	104	6	6	21	7	22	13	6	5	29	9
Northwestern	240	5	25	20	18	2	22	19	19	27	13
North Central	130	2	5	2	3	1	15	5	4	43	6
Northeastern	91	.....	2	1	.....	.....	17	1	3	35	5
	acres	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Southwestern	200	29.9	20.2	8.3	1.6	1.4	5.1	4.2	9.3	1.0	6.8
West Central	202	18.6	15.9	9.8	8.5	3.5	5.3	7.1	7.8	2.3	5.8
South Central	146	21.3	10.3	4.0	6.1	6.9	7.3	7.0	7.3	5.5	12.8
Southeastern	163	13.2	11.0	7.3	1.7	6.1	12.9	0.7	11.1	12.9	8.1
Central	152	13.2	11.5	5.5	4.2	2.9	7.7	8.4	5.5	15.8	9.1
East Central	104	5.8	6.0	2.0	7.3	2.2	12.5	6.1	4.4	27.8	8.3
Northwestern	240	2.1	10.3	8.3	7.3	0.7	9.2	8.1	7.8	11.2	5.3
North Central	130	1.7	3.6	1.2	2.5	0.4	11.8	3.8	2.8	32.7	4.7
Northeastern	91	.....	18.3	0.6	0.1	0.2	19.1	0.7	3.2	38.2	5.5

* Fifteenth Census of the United States: 1930. Agriculture, Vol. II.

† A list of the counties included in each district may be found in Bulletin 9 of the Minn. State Dept. Agri., Minnesota Crop and Livestock Statistics, 1930-1931.

Table 3. Average Size and Percentage Distribution Among Specified Size Groups of Farms in Southwestern Minnesota, by Counties, 1930*

County	Percentage, by size							Average size in acres
	Under 20 acres	20 to 49 acres	50 to 99 acres	100 to 174 acres	175 to 259 acres	260 to 499 acres	500 acres and over	
Rock	2.0	1.1	5.0	42.3	18.5	29.8	1.3	220
Nobles	3.0	2.0	5.0	44.3	20.1	24.2	1.4	208
Jackson	2.7	2.5	8.3	42.8	23.5	18.9	1.3	194
Martin	3.8	2.7	12.1	46.7	20.6	13.4	0.7	174
Faribault	4.1	3.2	9.9	43.3	24.7	14.3	0.5	178
Pipestone	1.9	1.3	5.2	43.3	18.4	27.0	2.9	223
Murray	3.5	2.2	6.6	40.1	20.9	24.5	2.2	213
Cottonwood	5.3	1.5	7.4	38.2	25.8	19.5	2.3	201
Watonwan	2.7	2.2	11.2	42.0	26.2	15.2	0.5	181
Lincoln	2.0	1.9	6.0	40.8	25.6	21.4	2.3	209
Lyon	2.8	1.9	5.5	35.6	24.9	27.0	2.3	220
Average	3.1	2.0	7.5	41.7	22.7	21.4	1.6	202
State	4.4	8.1	17.9	36.1	17.8	14.0	1.7	167

* Fifteenth Census of the United States: 1933. Agriculture, Vol. II.

can be handled as a family-sized unit. Farms in southwestern Minnesota are much above the average for the state in size (table 3). The average size of farms in the 11 southwestern counties in 1930 was 202 acres as compared with 167 acres for the state. Forty-six per cent of the farms in the southwestern part of the state range above 174 acres in size. Twenty-one per cent of the farms approximate a half section in size. The large size of the farms, together with the relatively high proportion of the land that is used to grow fattening grains (corn and barley) as contrasted with high-protein grains and roughages, such as oats and alfalfa, results in a substantial surplus of fattening grains over the quantity necessary for feeding the farm work stock, a poultry flock, and for fattening the litters of the number of brood sows that can be handled to advantage (table 4).

Compared with cattle, hogs have an advantage in the conversion of concentrated feeds into meat, as they produce more pounds of liveweight per bushel of corn or barley consumed, and they usually sell in the market at approximately the same price per hundredweight as finished cattle. But there is a limit to the number of hogs that it is feasible to raise on a family-sized crop and livestock farm. If an attempt is made to expand the hog enterprise beyond the number of brood sows that can be cared for during chore time, the farmer incurs an increasingly greater loss of pigs because of his inability to give the litters proper care without taking too much time from field work at critical seasons of crop production. Under these conditions it is usually more advantageous to use a part of the feed grains for cattle or sheep, which use labor at less critical periods in crop production, than to hire extra labor that would be needed only at farrowing time.

Table 4. Total Feed Produced Annually and Surplus Over Quantity Fed to Work Stock, Hogs, and Poultry on a 312-Acre Farm in Rock County, 1929-1931

Use of land	Area	Quantity produced less seed		Amount used for work stock, hogs and poultry			Amount available for cattle and sheep		
		Concentrates	Roughages	Concentrates	Roughages	Pasture	Concentrates	Roughages	Pasture
	acres	pounds	pounds	pounds	pounds	acres	pounds	pounds	acres
Corn: Grain	107	238,728	.....	171,528	.....	.....	67,200	.....	.....
Fodder	12	.....	110,000	.....	33,000	.....	.....	77,000	.....
Stalks	(107)	.....	.....	.....	.....	.....	.....	.....	107
Oats: Grain	47	79,712	.....	49,376	.....	.....	30,336	.....	.....
Straw	.....	.....	141,000	.....	.....	.....	.....	141,000	.....
Barley: Grain	22	40,120	.....	23,136	.....	.....	16,984	.....	.....
Straw	.....	.....	55,000	.....	.....	.....	.....	55,000	.....
Clover and timothy hay	32	.....	76,800	.....	33,000	.....	.....	43,800	.....
Alfalfa hay	14	.....	56,000	.....	3,200	.....	.....	52,800	.....
Alfalfa pasture	9	.....	.....	.....	.....	9	.....	.....	.....
Bluegrass pasture	69	.....	.....	.....	.....	9	.....	.....	60

Beef cattle and dairy cattle are both well adapted to using the kinds of feed produced in this area, but they differ in the proportions in which they can use the feeds to advantage. They differ also in the total quantities of feeds that they can use with a given application of labor.

In the maintenance of a dairy herd and in the production of dairy products, the ratio of pounds of farm-grown concentrates to pounds of dry roughage is approximately one to three (1 to

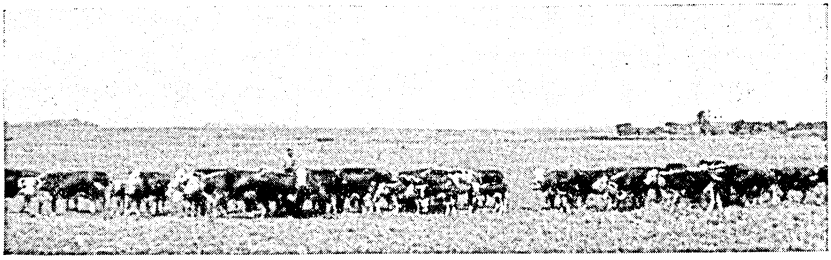

FIG. 2. A BEEF-BREEDING HERD ON NONTILLABLE PASTURE

A beef-breeding herd provides a means of utilizing large acreages of nontillable pasture land with relatively little labor.

3.2), whereas with a system of beef-cattle production in which a herd of beef cows is maintained for raising baby-beef calves for fattening the ration is one to less than two (1 to 1.7). With purchased feeder cattle the ratio is more than two to one (2.4 to 1). For dairy production no large amount of corn is necessary; in beef-cattle feeding, corn or some other fattening grain is essential. The ration of farm-grown concentrates for a dairy herd on representative dairy farms in southern Minnesota consisted of 13 per cent corn and 87 per cent small grains, whereas the ration of farm-grown concentrates for a baby-beef herd, including the fattening calves, on representative farms in southwestern Minnesota consisted of 80 per cent corn and 20 per cent small grain. Under conditions in which the feeding cattle were purchased and a breeding herd was not maintained on the farm, the farm-grown concentrate ration consisted of 86 per cent corn and 14 per cent small grain. A similar comparison between a beef-cattle herd and a dairy herd in the class of roughages consumed indicates that 41 per cent of the roughages used by a beef-cattle herd was wild hay, corn fodder, or stover, while only 14 per cent of the dairy-herd ration consisted of these low-grade roughages.[2] In addition, the beef-cattle herds undoubtedly obtained a larger proportion of their subsistence from unrecorded feeds, such as straw and cornstalks, than did the dairy herds.

[2] Crickman, C. W., Sallee, G. A., and Peters, W. H., Beef Cattle Production in Minnesota, Minn. Agri. Expt. Sta. Bull. 301, 1934, tables 8 and 9, pages 38-40.

Comparing a beef-cattle herd with a dairy herd on the basis of the pounds of feed used per hour of labor expended, the comparison indicates that with a given expenditure of labor, say 1,500 hours, a beef-cattle herd uses approximately 4.5 times as many pounds of grain and 2.5 times as many pounds of dry roughage as are used by a dairy herd.[3] This difference is significant for farmers in southwestern Minnesota, where the problem of balancing crops with livestock on large farms adapted to extensive feed-grain production is primarily one of feed utilization as contrasted with labor utilization on farms with a smaller crop acreage, such as those found in the central part of the state.

LABOR SUPPLY

Farmers using relatively high proportions of the land for corn and small grains on large farms in southwestern Minnesota are greatly rushed with crop work during the planting, cultivating, and harvesting seasons. But they do not have a comparable amount of productive employment during the winter months. The distribution of the labor demands of beef cattle are better suited to meet this situation then are dairy cattle. If the beef cows nurse their calves, the breeding herd requires little attention during the pasture season. The fattening cattle are not put into the feed lot until about November 1, and usually are marketed ahead of the rush of the summer work on crops.

The system of management of beef cattle can be varied in accordance with the relationship between the labor supply and the feed supply. Farmers having considerable family labor available throughout the year frequently milk the cows in the breeding herd, sell the cream, and feed the calves skim milk and grain. Farmers on the small farms often keep a milk-and-beef herd. A milk-and-beef herd provides additional productive employment over that provided by a straight beef herd of the size for which the farm would provide feeds and has an advantage over a dairy herd in the utilization of the feeds available. The beef calves consume a surplus of corn which could not be used to advantage in feeding milking cows. On the other hand, if the supply of feed grains, particularly corn, is abundant in relation to the labor supply or the supply of pasture, the feeders raised with a small breeding herd are supplemented with purchased feeders. Sometimes under such conditions all of the feeders are purchased.

PREFERENCE OF MANY FARMERS FOR BEEF CATTLE

Another factor of considerable importance in its influence on the type of farming in southwestern Minnesota is the general preference of farmers for a beef system of management. They

[3] *Ibid.*, table 8, pages 38-39.

naturally dislike the task of milking and the regularity with which it must be performed. Wherever, therefore, the nature of the cropping system is such that the feeds grown can be used to advantage in raising and fattening beef animals, the farmers generally will be found keeping beef-type cows.

Successful beef-cattle management requires special skill. Some men may have an inherent skill for handling cows and fattening their offspring. But most farmers who are successful with beef cattle have a background of experience that has contributed materially to the development of the enterprise. Experience in any type of farming and the skill it engenders for handling the various enterprises included is accumulative. Often farm-reared children, as they take their fathers' places, are able to begin where their fathers leave off. In much the same way a type-of-farming area gradually accumulates physical equipment specially adapted to the housing and feeding of a certain group of livestock enterprises. In southwestern Minnesota, approximately three generations of farmers have been accumulating experience in beef-cattle management and have been improving many of the farms of the area with buildings and equipment suitable for beef cattle and hog production. Thus experience in beef-cattle management and the nature of the improvements on the farms are important agricultural resources of the area.

SYSTEMS OF FARMING IN SOUTHWESTERN MINNESOTA

Minnesota farms were classified according to type in 1929 by the Bureau of the Census. Thirty-two per cent of the farms in the 11 southwestern counties set apart in figure 1 were classified

Table 5. Classification of Farms in Southwestern Minnesota, by Counties, According to Type of Farm, 1929*

County	Type of farm				
	Animal-specialty	General	Cash-grain	Dairy	Other
	per cent	per cent	per cent	per cent	per cent
Rock	51	21	22	2	4
Nobles	33	33	26	3	5
Jackson	27	27	34	6	6
Martin	31	35	19	8	7
Faribault	28	41	14	11	6
Pipestone	39	31	16	7	7
Murray	38	30	22	4	6
Cottonwood	28	36	24	6	6
Watonwan	30	41	13	11	5
Lincoln	23	38	21	12	6
Lyon	29	29	31	6	5
Average	32	33	22	7	6
State	12	30	9	36	13

* Fifteenth Census of the United States: 1930. Agriculture, Vol. III. Type of Farm.

Table 6. Percentage of Total Value of Farm Products Sold Represented by Specified Products on Animal-Speciality and General Farms in Southwestern Minnesota, 1929, by Counties*

Type of farm and county	Total farms	Class of product sold: Livestock — Farms reporting	Livestock — Proportion of total value	Livestock products — Farms reporting	Livestock products — Proportion of total value	Crops† — Farms reporting	Crops† — Proportion of total value
	No.	per cent	per cent	per cent	per cent	per cent	per cent
Animal-speciality farms							
Rock	678	100	68.5	98	16.9	83	14.6
Nobles	708	100	68.0	99	16.6	83	15.4
Jackson	626	100	65.2	98	19.2	77	15.6
Martin	895	100	66.4	99	19.2	80	14.4
Faribault	687	100	64.1	98	21.6	77	14.3
Pipestone	492	100	67.2	99	19.2	82	13.6
Murray	766	100	63.1	99	21.8	83	15.1
Cottonwood	548	100	63.6	99	19.7	84	16.7
Watonwan	443	100	67.3	98	22.6	64	10.1
Lincoln	357	100	62.1	99	24.1	79	13.8
Lyon	581	99	65.1	97	18.6	77	16.3
Average	.....	100	65.5	98	20.0	79	14.5
General farms							
Rock	280	97	39.8	99	27.1	95	33.1
Nobles	698	98	39.4	99	28.2	95	32.4
Jackson	757	97	37.2	99	30.0	94	32.8
Martin	804	99	34.0	100	35.8	93	30.2
Faribault	1,015	99	35.1	100	32.9	91	32.0
Pipestone	390	97	39.5	100	31.4	93	29.1
Murray	619	98	38.0	100	33.0	94	29.0
Cottonwood	702	98	38.0	100	32.7	92	29.3
Watonwan	613	99	38.5	100	32.5	91	29.0
Lincoln	607	99	34.3	100	36.0	96	29.7
Lyon	584	98	40.0	100	30.2	93	29.8
Average	.....	98	37.6	100	31.8	93	30.6

* Fifteenth Census of the United States: 1930. Agriculture, Vol. III. Type of Farm.
† Includes some forest products.

as "animal speciality" farms on the basis that 40 per cent or more of the total annual value of farm products came from beef cattle, hogs, and sheep (table 5). Thirty-three per cent of the farms were classified as "general" on the basis that there was no one source of income that represented 40 per cent or more of the total value of all products from the farm. Meat animals, however, were the principal source of income on these general farms. On the average, beef cattle, hogs, and sheep represented 37 per cent, livestock products 32 per cent, and crops 31 per cent of the total value of products sold on the general farms (table 6). Thus on 65 per cent of the farms in the area, approximately 37 per cent or more of the total value of all products was from meat animals, chiefly beef cattle and hogs. The percentage of receipts from the sale of livestock averaged 68 per cent or above on the animal-specialty farms in Rock and Nobles counties. It ranged downward to an average of 34 per cent on the general farms in Martin

County. Of the 35 per cent of the total number of farms in southwestern Minnesota not classified as livestock-specialty or general farms, 22 per cent were classified as cash-grain farms and 7 per cent as dairy farms. The other 6 per cent were distributed among the other six type-of-farm groups designated by the census bureau.

SYSTEMS OF BEEF-CATTLE PRODUCTION

On the 65 per cent of the farms that had meat animals as a principal source of income, a beef-cattle-and-hogs system of farming predominates. The importance of the beef-cattle enterprise on different farms ranged from a few cows and young cattle to commercial feeding operations in which several hundred purchased feeders are fattened on the farm. Within this range in methods of beef-cattle production have developed three fairly distinct systems: baby-beef, milk-and-beef, and fattening of purchased cattle.

On the baby-beef farms a cow herd is maintained primarily for the raising of calves for fattening as baby beeves. The numbers of cows on these baby-beef farms range from 15 to 35. The cows usually are either purebreds or high grades, the Shorthorn and Hereford breeds being represented by the largest numbers. Spring freshening predominates, and the calves are permitted to run with their dams until they reach six to eight months of age. They are then fattened on a full feed of concentrates and roughages. The feeding period ranges from 200 to 225 days. The calves average about 400 pounds in weight when put into the feed lot, and they are marketed with a gain of about 500 pounds.

On the milk-and-beef farms, the cattle enterprise is a combination of beef-cattle production and dairying with milk-and-beef type cows. Herds range from 5 to 25 cows. There seldom is any concentration of freshening dates within the year. The cows are milked and the calves are hand fed, largely on skim milk, until they are old enough to depend entirely on pasture or a grain and roughage ration. If fattened as baby beeves, the calves usually enter the feed lot weighing about 350 pounds. The calves born during the late summer and fall usually are "roughed" through the winter and carried on pasture for a season before fattening as yearlings. The yearlings enter the feed lot weighing about 650 pounds.

A third group of farmers purchase thin feeder cattle usually in the fall and fatten them during the winter and early spring months. Frequently the raising of feeder cattle is a minor part of the beef-cattle enterprise on farms on which purchased cattle are fed. The purchased feeders may be pastured in the fall be-

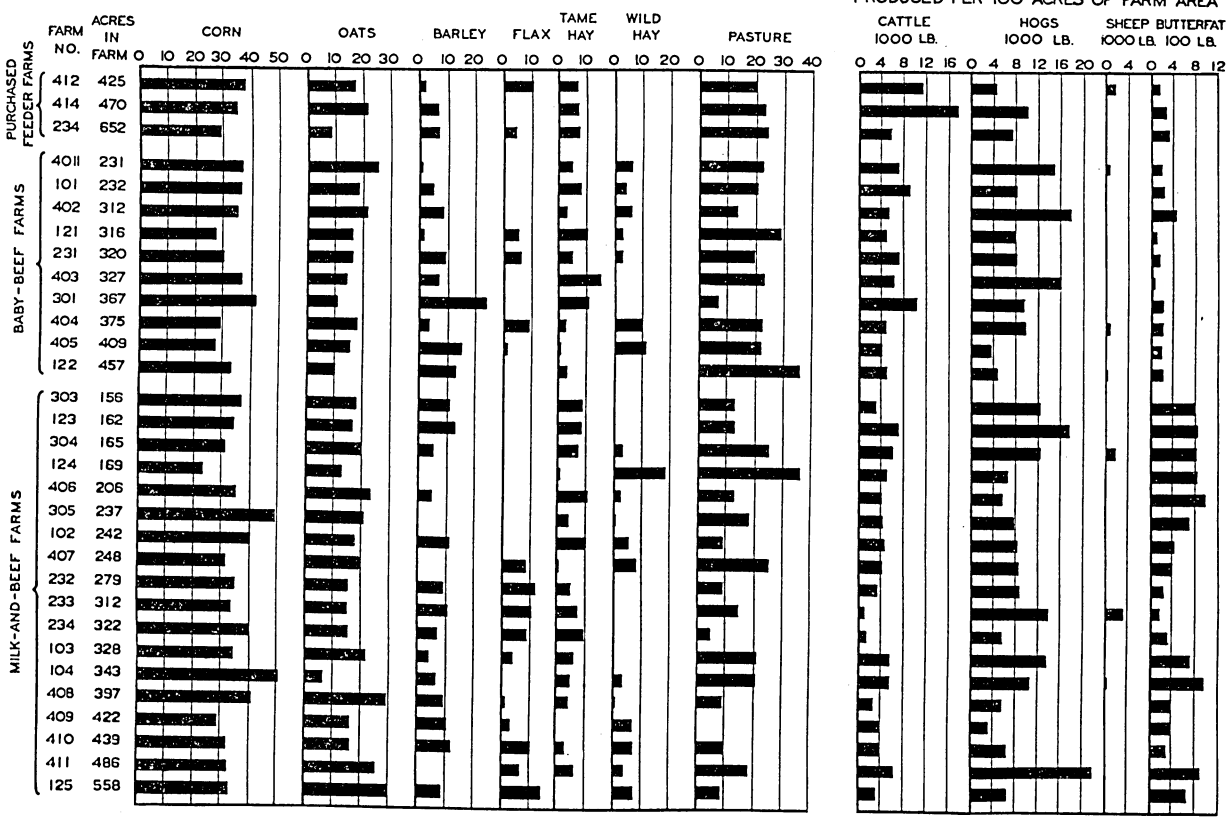

FIG. 3. CROP AND LIVESTOCK PRODUCTION ON FARMS IN ROCK AND NOBLES COUNTIES

Each line gives the organization of one farm. The proportion of the farm area in pasture and wild hay was dependent largely upon the amount of nontillable land in the farm. Oats and barley are grown interchangeably in the cropping system. There was less variation in the combined acreage of these two crops than in either crop considered separately.

fore going into the feed lot, but they are seldom pastured during the summer at the end of the feeding period.

The Minnesota Agricultural Experiment Station and the Bureau of Agricultural Economics of the United States Department of Agriculture made a detailed study of the organization and operation of a group of representative beef-cattle farms in Rock and Nobles counties (fig. 1) during the three-year period, 1929-1931. Twenty-two farms were included in a detailed accounting route in 1929, 23 farms in 1930, and 22 farms in 1931. Complete records of the crop and livestock production; the labor, power, equipment, and materials used in production; the usual livestock practices; and the financial transactions for each farmer for each year were obtained.

One of the three systems of beef-cattle production previously described predominated on each of the farms studied.[4] Some difficulty was encountered in selecting farms that adhered strictly to one system of production. But the predominance of one system was sufficiently marked on each of the farms to permit its classification into one of the three groups. The classification of each of the farms studied, its size in acres, the percentage of the area used for the different crops, and the pounds of cattle, hogs, sheep, and butterfat produced per 100 acres are shown in figure 3. The farms averaged 334 acres in size. Seventy-six per cent of the average farm was used for crops, 19 per cent for pasture, and 5 per cent for farmsteads, roads, and headlands. The 76 per cent that was used for crops was divided as follows: corn, 34.4 per cent; oats, 17.9 per cent; barley, 7.3 per cent; flax, 3.4 per cent; tame hay, 6.2 per cent; wild hay, 3.8 per cent; and miscellaneous crops, 3 per cent. Approximately one half of the pasture, on the average, was classified as permanent pasture on nontillable land. The variation from these averages is shown in figure 3.

The three farms that were classified in the purchased-feeder group are not wholly commercial-fattening farms. Each of the farms had a beef-breeding herd on it. More feeders were purchased, however, than were raised on the farm. These farms averaged 112 acres larger in size than the 10 farms classified as baby-beef farms. The cropping systems did not differ materially on the two groups of farms. The purchased-feeder farms produced more pounds of beef cattle but not so many pounds of marketable hogs per 100 acres. The pounds of marketable hogs produced per farm were approximately equal, however, on the two groups of farms.

The baby-beef farms averaged approximately 30 acres larger in size than those with milk-and-beef herds. The additional acre-

[4] For a fuller description of the management practices and the unit costs of beef-cattle production on the farms studied, see Minn. Agri. Expt. Sta. Bull. 301, Beef Cattle Production in Minnesota, by C. W. Crickman, G. A. Sallee, and W. H. Peters.

age in the baby-beef farms was accounted for by the higher average acreages in pasture and hay. The average acreage in barley was slightly higher on the baby-beef farms, but there were otherwise no material differences between the two groups of farms in the systems of grain cropping. The average production of hogs was approximately equal for both groups. But with fewer acres in pasture and hay on the milk-and-beef farms, the size of the breeding herds was limited accordingly. The smaller breeding herds result in a correspondingly small lot of farm-raised calves for fattening. The surplus of feed grains over that required for the hog enterprise was about equal to the surplus on the baby-beef farms. In order to market all of this surplus of feed grains through the cattle and in order to provide a comparable amount of productive employment with the smaller herds, a part of the surplus of feed grains was fed to the beef cows to increase their butterfat production and the cows were milked. The butterfat production on the milk-and-beef farms averaged 613 pounds per 100 acres as compared with 224 pounds per 100 acres on the baby-beef farms.

In general, the different types of beef-cattle production are the result of adjustments in the system of farming to the characteristics of the farm, the farm-family labor supply, the inclination and ability of the operator for handling beef cattle under the different systems of production, and to changes in price relationships. The influence of the first three factors on the system of farming has been discussed in the previous section. Changes in the relationships between the prices of cattle and the prices of dairy products, hogs, and market grains influence shifts in the emphasis placed on the crops grown and in the form in which they are marketed. Farms and farmers vary in their adaptability to flexibility in organization and management. Farmers having productive resources that are unusual in some respect often find it more difficult or less to their advantage to vary their farm program in response to price changes.

READJUSTMENTS NEEDED

In the absence of a more systematic planning of the organization of the farm business, the adjustments are incomplete or misdirected in many instances. A closer adherence to the system of beef-cattle production for which the conditions at the farm are best suited would improve the present organization of many farms in southwestern Minnesota. On the majority of farms having conditions favorable to a beef-cattle enterprise, particularly on the farms 240 acres and over in size, the system of beef-cattle production probably should be the baby-beef system if the operator has experience in the methods of beef-cattle production. The

baby-beef system is a highly specialized line of beef-cattle production that is peculiarly adapted to farms with a plentiful supply of fattening feeds and sufficient pasture for summer maintenance of the breeding herd and nursing calves. A baby-beef herd unit provides the maximum utilization of a combination of concentrates, roughages, and pasture per unit of labor expended. The cow herd utilizes land in permanent or annual pasture during the summer and can be maintained during the winter on unsalable rough feeds, such as cornstalks, straw, and low-quality hay. The fattening calves use the surplus of corn and other grains. On many other farms, the choice should be the milk-and-beef system. A herd maintained under the milk-and-beef system uses less pasture but more labor proportionately to concentrates than does a baby-beef herd. On another group of farms on which most or all of the land is adapted to cultivation, there is insufficient pasture for maintaining a breeding herd unless sweet clover can be grown successfully in competition with the grain crops. In the absence of sweet-clover pasture to supplement the feed grains, the surplus of fattening grains can be used to advantage for fattening thin purchased feeders.

An important reason for specialization is that the type of cows giving best results with a baby-beef system differs from the type giving best results with the milk-and-beef system. With the baby-beef system, the important consideration is that the cows produce calves of the beef type that will feed out satisfactorily. Cows for a milk-and-beef system should be, first of all, good milkers and, secondly, they should produce an acceptable type of feeder calf.

Feeders of purchased cattle should study carefully the relationship between the prices that may reasonably be expected for the cattle when fat and the prices of marketable feeds in order to avoid using feeds on the farms that could be sold on the market with a higher return. It is also important that the cattle be purchased at a price lower than that expected for the fat cattle so as to secure a margin on the sale value of the purchased weight. Profit in the fattening of purchased cattle is dependent on the margin of selling price over purchasing price as well as on economical gains. Successful feeders of purchased cattle more often are specialists in judging the market and the value of feeder cattle than in the art of obtaining a superior finish on the animals in the feed lot. This latter observation is particularly true in the case of the large-scale commercial feeders. Feeders without experience in buying and fattening cattle should be cautious in undertaking commercial feeding on a large scale.

Frequently, unwise planning traces back to the cropping program. While it has been assumed that the character of the land,

together with its attendant climatic conditions, determines the organization of pasture and crops and that the cropping program, through the products which it yields, determines the character of the livestock system, there are many interrelationships between livestock and crops in which the livestock system reacts to influence the cropping system.

To obtain a better balance between the crop and livestock programs, many beef-cattle farmers in southwestern Minnesota could advantageously grow more alfalfa hay for feeding. Alfalfa hay should displace wild or tame grass hays wherever possible. It should also displace corn fodder as a roughage. In some instances more hay is needed to provide a better balance between roughages and concentrates in the ration. Sweet-clover or alfalfa pasture should displace timothy or plowable bluegrass pasture wherever additional pasture is needed to supplement the nontillable land in pasture. A combination of bluegrass and sweet-clover pasture is preferable to either alone—the bluegrass for early spring and fall use and the sweet clover for midsummer grazing. Alfalfa pasture should be available for the brood sows and their pigs. This should be large enough to yield a fair crop of hay in addition to its use for pasturing the hogs. More feed is obtained from an acre of land in alfalfa pasture under such a system of management than by grazing the pasture with hogs to its fullest capacity.

PLANNING THE FARM ORGANIZATION FOR BEEF-CATTLE PRODUCTION

The Problems Involved

The recommendations in the preceding section for improvements in the organizations of beef-cattle farms in southwestern Minnesota are only suggestive of the type of adjustments which should be given consideration by the farm operators. The problems involved in planning the organization of a farm include (1) the selection of a long-time production program based on the more or less permanent elements in the situation at the farm—its location with reference to markets, its size and the suitability of the land for growing the crops common to the area, the extent and nature of the investments in buildings and equipment, the money and labor supply at the command of the operator; (2) the planning of changes in the long-time production program from time to time to keep it properly adjusted to price trends, technical progress in farming, and changes which may be taking place in the soil on the farm as a result either of depletion or improvement of its productivity; and (3) the determination of the desirability of temporary changes to meet predictable fluctua-

tions in costs and prices, and the miscarriage of plans resulting from crop failure or the loss of productive animals.

Farms and farmers differ so widely and market conditions change so frequently that general recommendations as to when and where to make adjustments in production programs are limited in their usefulness to a particular farmer. Farmers have different amounts of land, labor, power equipment, and mobile capital or credit at their command. They differ in operating skill and managerial ability. Obviously, the desirability of different production programs and of changes in any one of them must be judged by relating the plans to a particular farm. The remainder of the bulletin purposes to show how the organization of a farm may be planned by the individual operator with the aid of data pertaining to his farm and of other general information readily available.

The Analytical Process in Planning

The farmer interested in obtaining maximum utilization of his productive resources—land, available labor, equipment, and managerial capacity—should study his individual problem and decide when to make changes in his production program and the direction that they probably should take by acquiring a knowledge (1) of the possibilities of different lines of production under the conditions peculiar to his farm and with the degree of technical efficiency he and his helpers are capable of attaining, and (2) of the market situation for the various enterprises open to him for selection. Having determined the changes, if any, which appear advisable, he should prepare, preferably on paper, estimates of the returns and variable costs involved in operating his farm with the production program adjusted to include the changes proposed, as compared with continuing its operation without the respective changes. The comparison of returns above variable costs will indicate the production program that appears most promising during the period into which he is projecting his plans.

The analytical process of making the estimates referred to in the preceding paragraph is commonly known as "budgeting." Budgeting consists of distributing systematically the land, the power, the equipment, the productive materials, and the labor supply under the farmer's control, together with such additional services and materials as must necessarily be associated with the above, to the use of different enterprises and of recording the probable production in one year or some other designated period resulting from the proposed application of the cost factors. A suggested disposition of the production of each enterprise is indicated, that is, whether for sale, for use in the home, or for use on the farm. Finally, prices are placed on all products for sale

and on all items of cost for which there would be a cash outlay. A separate budget is prepared for each production program under consideration. As the usual objective in budgeting farm plans is to show how the returns from the farm business as a whole would be affected by using a part of the productive resources in each of several different ways, it is necessary to consider only the expenses that vary directly with changes in the organization. In comparisons between plans of operation that would include the same crops and the same classes of livestock, but in somewhat different proportions, the cash expenses for such items as hired labor, threshing, seeds, and feed are most important. If, however, comparisons are made between production programs that are different in major aspects, other expense items must be considered.

For example, in measuring the effect on returns of a shift from a production program including the fattening of purchased steers to one including the raising and fattening of baby beeves, the difference in the livestock, building, and equipment investments under the two systems of management would affect the interest charges. Furthermore, if the objective were to compare the returns that could be expected from the farm in its present size with the probable returns from it enlarged by the addition of more acres, consideration would have to be given to such items as additional taxes, interest, and the other land charges involved.

Basic Data Needed in Planning

To prepare a budget, the farmer must bring together specific basic data of three general types that are related to his particular circumstances. First, he will have need for data on the physical yields of products that may normally be expected on his farm under his management and operation from the different crops and kinds of livestock that will be included in the budget. Secondly, he will need data on the amounts of labor, power, equipment, feed, and materials that may reasonably be expected to be used on his farm in the production of one acre of the different crops and one unit of the different kinds of livestock or livestock products. The data on amounts of the cost factors should be supplemented with data on the seasonal distribution of the demands of each crop and each class of livestock for labor and power, together with data on the probable number of work days available for each crop operation. Insofar as it is possible, data should be available that indicate the yields of crops that may be expected on the farm with the use of different amounts of labor, power, and materials and with these different factors combined in various proportions. Similar data indicating the yields of livestock products that may be expected with the use of different

quantities of feed and with the different quantities combined into various rations should also be available.

A third type of information that he will need is a list of prospective prices. This list should include his forecast of the sale price of each of the products that would be marketed and the purchase price of each of the cost factors for which there would be a cash outlay that would vary in the different production programs which he has under consideration.

Sources of Data

If in the past he has kept production records and records of feed, labor, and power used, he will have a fairly satisfactory basis for establishing normal yields and normal physical costs for the different enterprises included in his production programs of former years. If he does not have any records on his own farm, he should relate his judgment to standard data based upon the records of groups of farmers practicing a similar type of farming, and to data showing the results of experimental trials in growing crops and feeding livestock. Incomplete farm records should be supplemented in a similar manner.

An essential part of the three-year accounting study of representative beef-cattle farms in Rock and Nobles counties was the collection of information useful in planning and budgeting adjustments in production programs for beef-cattle farms. The data secured on the unit physical costs of production and the seasonal distribution of the use of labor and power have been summarized into ranges, averages, and standards for the significant items. These summary data are published for reference in the appendix to this bulletin. Appendix tables I to IX illustrate the type of production and physical cost data previously referred to as being essential to the budgeting analysis. The "standards" represent the accomplishment of the farmers who were 25 per cent above the average in the scale of efficiency, as measured by the expenditure for the production of a unit of product. They indicate the achievement possible under reasonably good management with a well-balanced system of farming. As such, they may be used by different farmers as a base for checking the effectiveness with which they are utilizing their productive resources. Farmers with unusually favorable conditions should expect to attain even lower costs, while those less favorably situated may be making the best of their opportunities when operating with somewhat higher physical costs.

In the absence of more specialized data relating to a farm, the averages and the standards set forth in appendix tables I to IX will serve as a useful guide in compiling basic quantities for use in planning and budgeting adjustments in production programs

for beef-cattle farms in southwestern Minnesota. But in using them as a guide, each farmer should bear in mind that the quantities of labor, power, feed, and materials that may be assumed to be basic to the production of the different crops and classes of livestock or livestock products vary from farm to farm and from year to year on any one farm. The farm-to-farm variation is well illustrated by the range in each of the items included in appendix tables I to IX. This variation reflects (1) differences

Table 7. Assumed Relative Prices for Products to Be Sold and for Expense Items

Products to be sold		Expense items	
Item	Price	Item	Price
Cash crops		**Feeds**	
Corn, bu.	$ 0.45	Bran, cwt.	$ 1.10
Oats, bu.	0.27	Middlings, cwt.	1.20
Barley, bu.	0.55	Linseed meal, cwt.	1.80
Flax, bu.	1.65	Tankage, cwt.	2.50
Alfalfa hay, ton	10.00	Meat scrap, cwt.	2.50
Livestock and livestock products		**Seeds**	
Fat cattle, cwt.	7.50	Sweet clover, lb.	.06
Fat cows, cwt.	3.75	Red clover, lb.	.20
Veal, cwt.	9.50	Timothy, lb.	.07
Hogs, cwt.	6.50	Alfalfa, lb.	.20
Lambs, cwt.	6.50	**Contract services**	
Sheep, cwt.	5.00	Threshing: Oats, bu.	.02½
Chickens, lb.	.10	Barley, bu.	.04
Eggs, doz.	.18	Flax, bu.	.10
Butterfat, lb.	.27	Ensilage cutter hire, hr.	1.00
Wool, lb.	.25	Labor with board: Per mo.	30.00
		Per day	1.50
		Miscellaneous	
		Twine, lb.	.08
		Baby chicks, per 100	6.00
		Feeder cattle, cwt.	6.00

among farms in the quality of the productive resources, including the farmer's technical skill and his managerial ability, and (2) the possibilities for substituting, within limits, one productive element for another as a means of economizing the factor which may be either temporarily scarce among the farmer's productive resources, or, if it is one for which a cash outlay must be made, high priced in the market. Because of these variations and because it is highly desirable to have the basic quantities of the cost factors related to the individual farm, to the farmer, and to the conditions in the markets, each farmer should give considerable thought to the determination of his physical costs of production. After considering all the data available in the light of the conditions on his own farm, he should finally make estimates of yields and the physical costs of obtaining those yields. These estimates should be used in the preparation of the budgets.

It will also be necessary for each farmer to make his own price assumptions, basing his conclusions upon the best information available regarding the probable trend of prices over the period into which he is projecting his program. The facts as to trends in production, supplies on hand, and the changes in demand likely to occur are to be found in market-news reports, agricultural-situation reviews, and in agricultural-outlook statements issued by the Minnesota Agricultural Extension Service and by the United States Department of Agriculture.

The prices that will be used in a following section of this bulletin in illustrations of the application of farm planning are presented in table 7. These prices represent, as nearly as could be estimated, a normal relationship between prices, but they are not forecasts of price levels.

PLANNING PRODUCTION PROGRAMS FOR BEEF-CATTLE FARMS

There are certain general considerations in the planning of production programs of beef-cattle farms which have fairly wide application. These considerations may be classified into two groups, one that concerns the planning of the cropping system and one that relates to balancing crops and livestock.

Planning the Cropping System

The primary consideration involved in the development of the cropping system on a beef-cattle farm in southwestern Minnesota is to provide for the variety and amounts of feeds needed for the optimum-sized beef-cattle herd and the other livestock enterprises associated with beef cattle in the livestock system. There should be, in other words, a balance between the production of the three types of feed crops—concentrated feeds, roughages, and pasture—that is related to the feed requirements of beef cattle and the other classes of livestock associated with them.

Other considerations, such as the maintenance of the productivity of the soil and the control of weeds, require that intertilled crops, small grains, and grass or legume crops succeed each other within reasonably short periods of time and in a fairly regular order. To facilitate regularity in the order of succession, the acreages of each of the three types of crops should be either approximately equal each year or in some multiple of the acreages of the other type or types.

A rotation of these three types of crops has the additional advantage of economy in seedbed preparation. The small grains and flax may follow corn without again plowing the land, and a hay or pasture crop may be seeded with the small grains or flax

without any additional seedbed preparation. Furthermore, a well-balanced rotation provides maximum productive use of labor, power, and equipment by spreading the demands for the use of these factors over the crop-growing season. The data in appendix table V, showing the periods for the performance of field-

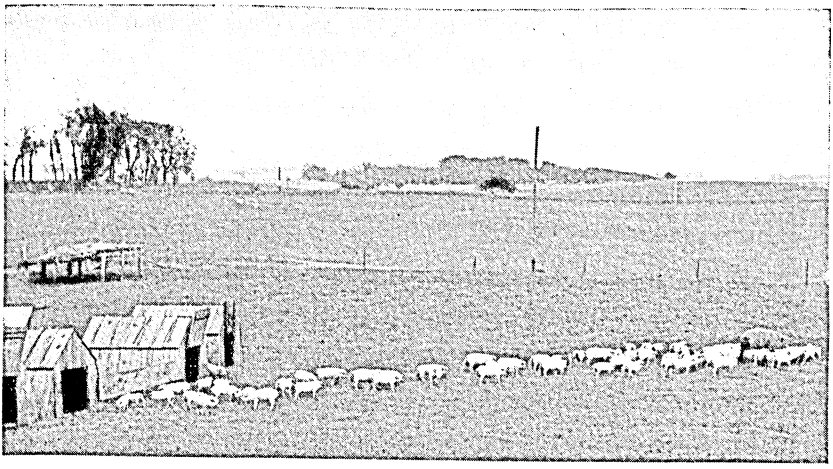

FIG. 4. CLEAN PASTURES HELP TO MAKE THRIFTY PIGS
The use of clean legume pastures for growing pigs is an important step in obtaining thrifty pigs and economical gains.

crop operations in southwestern Minnesota, indicate the supplementary relationships among corn, the small grains, and the hay crops in the use of labor.

The selection of the crops to represent each of the type groups should be governed by the relative feeding or market value of an acre of the crops in the respective groups, insofar as that can be done without too seriously neglecting the two important requirements of a rotation mentioned above—labor distribution and maintenance of soil fertility.

A comparison of the quantity of feed that can be grown on an acre in the different feed crops available and the feeding value of the yield of different feeds as measured by the unit-content of digestible nutrients and percentage of protein is presented in table 8. These comparisons include the feedable crops commonly grown in southwestern Minnesota. They are based on standard crop yields per acre and average analyses. The items of comparative costs are standard amounts. On the basis of the standard yields used, an acre in corn produces approximately 85 per cent more pounds of digestible nutrients than is produced with an acre of oats and 35 per cent more than is produced with an acre of barley. An acre of corn, however,

Table 8. Feeding Value Yielded per Acre by Various Crops in Southwestern Minnesota

Crop	Yield per acre less seed*	Feed	Pounds of digestible matter available†		Production Costs		
			Total digestible nutrients	Digestible protein	Man labor	Horse work	Direct cash costs
		lb.	lb.	lb.	hr.	hr.	dollars
Corn	38.0 bu.	2,128	1,739	151	11.0	36.8	.....
Oats	42.0 bu.	1,344	946	130	5.1	11.3	1.16
Barley	34.0 bu.	1,632	1,295	147	5.2	11.5	1.47
Corn fodder‡	2.5 tons	5,000	1,804	139	10.3	31.9	.40
Corn silage	7.5 tons	15,000	1,995	150	15.6	44.6	1.40
Alfalfa hay	2.25 tons	4,500	2,295	477	6.5	10.7	.60§
Clover and timothy hay	1.25 tons	2,500	1,232	128	3.8	6.1	.81¶
Sweet clover hay	1.25 tons	2,500	1,267	268	3.8	6.1	1.20
Wild hay	1.00 tons	2,000	964	60	3.9	6.6	.....

* Based on data from appendix table III.

† Based on average analyses given in Feeding the Dairy Herd, Minn. Agri. Expt. Sta. Bull. 218, by Eckles and Schaefer, and in Feeds and Feeding, by Henry and Morrison.

‡ Original feeding value has been reduced one fourth to compensate for losses by weathering and by failure of animals to consume the whole plant.

§ Seed cost based on the assumption of a four-year stand.

¶ Seed cost based on the assumption of a two-year stand.

requires approximately twice as much labor for its production as do either of the small grains. But corn does not involve any direct cash outlay for such items as twine and threshing. The charges for the use of land and equipment should be approximately the same for corn as for the small grains. Insofar as corn can be substituted in the rotation for the small grains without disrupting a soil-fertility program and without its heavy seasonal demand for labor, power, and equipment use exceeding the available seasonal supply of these productive factors, it has a decided advantage over the small grains in economy of production of grain feed.

As between the small grains, an acre in barley may be expected to produce approximately 35 per cent more pounds of digestible nutrients in the grain than will be produced by an acre in oats. The costs of producing barley and oats are practically the same. In other respects, oats have a slight advantage over barley. The percentage of protein in oats is somewhat higher than in barley, thus giving it more value as a feed for work stock and growing animals. Oats usually produce more straw per acre than barley, and oats straw is a more valuable feed. Oats and barley supplement each other in the use of labor, power, and equipment in the same manner as these crops together supplement corn (appendix table V).

Among the roughages, an acre in alfalfa may be expected to produce approximately 15 per cent more digestible feed than an acre in corn fodder or corn silage and approximately 85 per

cent more than an acre in either clover and timothy hay or sweet-clover hay. Compared on the basis of digestible protein produced per acre, alfalfa yields more than three times as many pounds as corn silage or corn fodder and approximately four times as many pounds as clover and timothy hay. Herein lies the chief advantage of alfalfa as a feed crop. Protein is the element most likely to be deficient in the farm-grown rations, and it is the most costly element if purchased. The protein content of a feed is usually valued at approximately five times as much as its carbohydrate content. Alfalfa not only produces more feed of better quality, but an acre can be produced with considerably less labor and power than an acre of corn silage or corn fodder (table 8). As compared with timothy and clover

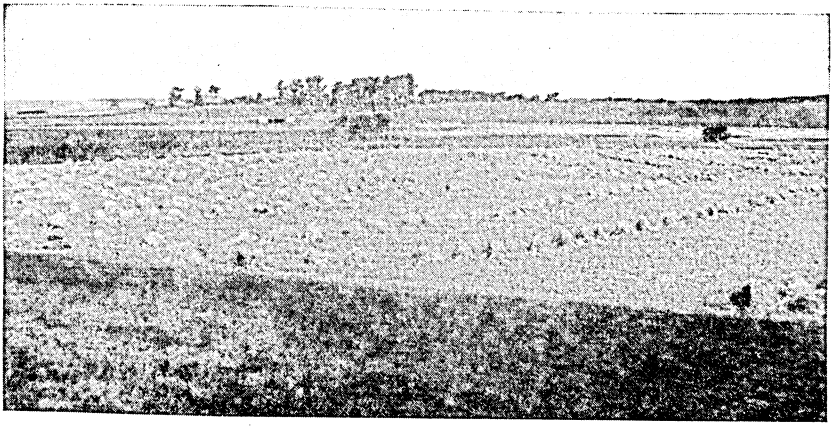

FIG. 5. A BOUNTIFUL CROP OF OATS ON A LIVESTOCK FARM

The feeding of livestock and the return of the manure to the fields is important in maintaining high crop yields.

hay, the advantage that alfalfa has in yield more than offsets its additional labor and power costs. Wild hay, of course, compares very unfavorably with any of the roughages grown on tillable land.

Alfalfa can be grown successfully on most farms in southwestern Minnesota. Wherever it has the advantages indicated by the data in table 8, it should without doubt constitute the principal roughage crop on beef-cattle farms. It should also be used as the chief pasture crop for hogs.

An abundance of nutritious pasture is essential for economical maintenance of beef-cattle breeding herds. As a large part of the pasture on most beef-cattle farms in this area is on nontillable land, bluegrass is the leading pasture grass. Bluegrass probably is the best grass available for nontillable land in this

area. It gives satisfactory results if properly managed. Either the practice of providing a pasture sufficiently large to permit more growth than the stock will consume during the spring and early summer, thus storing up feed for the midsummer dry period, should be more generally observed or the bluegrass should

FIG. 6. MILK-AND-BEEF COWS ON SUDAN-GRASS PASTURE

Sudan-grass pasture may be used to supplement bluegrass or sweet-clover pastures. It provides pasturage at the time bluegrass or sweet-clover pastures are producing relatively little feed.

be supplemented with some other pasture on tillable land. Timothy, although widely grown, is not an entirely satisfactory pasture grass for supplementing bluegrass. Both grasses become dormant during midsummer.

Sweet clover has many advantages over timothy as a pasture plant for beef-cattle farms in this area. It fits into a grain rotation to better advantage. It has a greater carrying capacity. It is a better soil-improvement crop, and it will furnish pasture throughout the summer if properly managed.

The usual grazing period of second-year sweet clover is from May 15 to August 15. Sometimes the grazing period is cut short in late summer. The first-year crop usually can be pastured after September 1. The gap which may appear between the end of the grazing period of the second-year crop and the time when the spring seeding of sweet clover can be heavily grazed without danger of injury to the development of the crop the following spring can be filled with a permanent pasture that has not been heavily grazed earlier in the year or with a small acreage of temporary pasture, such as Sudan grass.

One acre of sweet clover provides pasturage for about two mature cattle. Hence if the entire acreage of small grains is also

seeded to sweet clover, only a part of the new seeding will be needed for pasture the second year of the crop. That part of the new seeding not needed the following year for pasture can be grazed earlier and more heavily if necessary to provide sufficient late summer pasture, as injuring its later development will do no harm other than lessening its fertilizing value. It will be plowed under in the spring.

While most beef-cattle farmers in southwestern Minnesota use practically all of their land for the production of feed crops, some prefer to distribute the risk of price fluctuations by growing one or more cash crops. Many others produce more feed crops than are needed for feed on the farm. As previously indicated, flax is the principal crop commonly grown exclusively for direct sale. A surplus of corn, oats, or barley may be available for sale. The question arises: Which is the most profitable crop to grow for direct sale? A comparison of these four crops, as presented in table 9 in which the standard yields presented in appendix table II and the assumed prices set forth in table 7 are used, will serve as a guide in answering the question.

Table 9. Cash Value Yielded per Acre by Various Southwestern Minnesota Crops

Item	Corn	Oats	Barley	Flax
Standard yield, bu.	38.0	45.0	36.0	13.0
Amount seeded, bu.	.2	3.0	2.0	.6
Net yield, bu.	37.8	42.0	34.0	12.4
Relative sale price	$ .45	$ .27	$ .50	$ 1.65
Gross cash value	17.01	11.34	17.00	20.46
Direct cash costs				
Threshing		.84	1.44	1.99
Twine		.26	.24	.22
Seed				
Total cash costs		1.10	1.68	1.21
Cash value after deducting direct cash costs	$17.01	$10.24	$15.35	$19.25
Hours of man labor used	11.0	5.1	5.2	6.1
Hours of horse work used	36.8	11.3	11.5	14.2

On the basis of the yields and prices used, the comparative values above direct cash costs shown in table 9 indicate that flax may be expected to give higher cash returns per acre than any of the other crops which are commonly grown for direct sale. The difference in favor of flax is $2.24 an acre as compared with corn, $3.90 an acre as compared with barley, and $9.01 an acre as compared with oats. Flax has an advantage over corn in labor and power costs, but it has a slight disadvantage in that respect as compared with barley or oats (table 9). On the basis stated

above, corn has an advantage in returns over barley and oats. The difference was $1.66 as compared with barley and $6.77 as compared with oats. The advantage of corn in cash value is partly offset, however, by the lower power and labor costs of barley and oats. With different relationships among the yields of the different crops and with price relationships changed, the comparative per-acre cash values of these crops would change accordingly.

The principal competition among the four crops when grown for direct sale is between flax and barley. They compete more directly for labor than do flax and corn or barley and corn. Where flax yields slightly more than one third as many bushels per acre as barley and when the price of flax is slightly more than three times that of barley, flax may be expected to have a comparative advantage. "Contrary to the ideas held by some, flax is no harder on the land than wheat or oats as far as the removal of plant nutrients from the soil is concerned."[5] Other than yield and price, the factors that may influence the advantage of flax as compared with corn and of corn as compared with barley are the labor available for work on crops and the quantities of corn and barley needed for feed. If the maximum quantity of corn that can be produced is needed for feed, the competition is largely between barley and flax. The standard yield of 13 bushels per acre for flax is based upon the assumption that the crop will be grown on land reasonably free of weeds. To obtain the standard yield, many farmers would find it necessary to give additional attention to the control of weeds.

Balancing Crops and Livestock

The problem of the utilization of "nonmarketable" resources on beef-cattle farms in southwestern Minnesota is discussed earlier in this bulletin. The data presented in table 4 and figure 3 indicate the amounts of nontillable pasture and such feeds as cornstalks, straw, wild hay, and other roughages which must be converted into animal products to put them into a marketable form. The data in appendix tables VIII and IX indicate the extent to which workers and horses would be idle between cropping seasons if the farming operations were confined to the production of crops. The maximum utilization of these nonmarketable resources is a consideration of first importance. The beef-cattle herd ordinarily should be of the size that will utilize all of the surplus roughages produced on the farm.

The proportion of the surplus supply of corn and other marketable feeds which should be fed to beef cattle is dependent on the size of the surpluses over the quantities ordinarily used for

[5] Arny, A. C., and others, Flax Facts, Minn. Spec. Bull. 128, 1930.

feeding work stock. As was pointed out on page 8, and for the reasons given there, beef cattle are at a disadvantage as compared with hogs in the conversion of fattening grains into meat. On the other hand, the "nonmarketable" feeds are used most advantageously when fed to beef cattle in combination with feeds

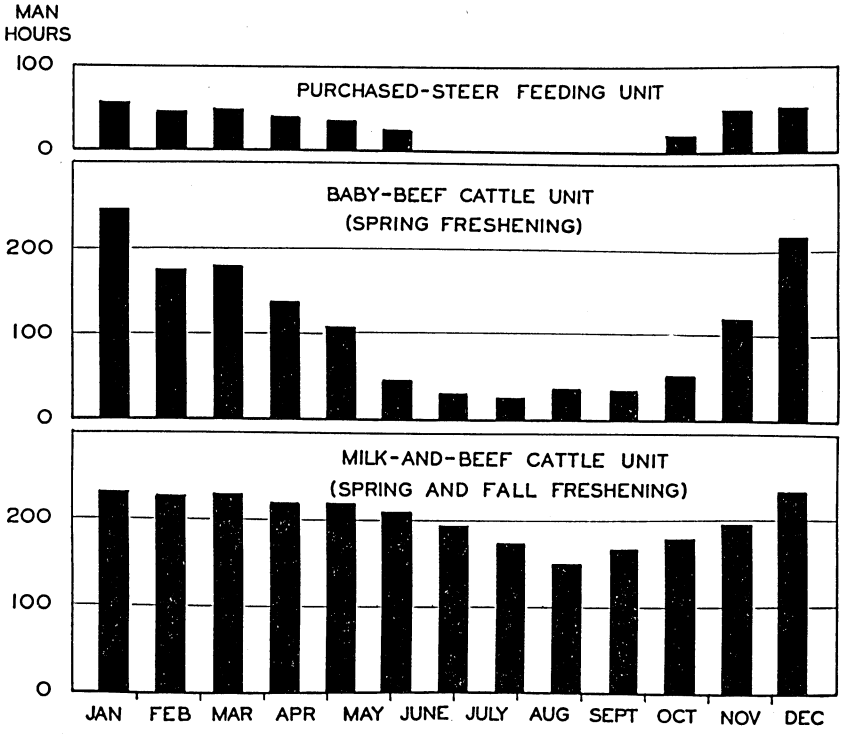

FIG. 7. DISTRIBUTION OF LABOR, BY FOUR-WEEK PERIODS, EXPENDED ON HERD UNITS OF BEEF CATTLE MAINTAINED UNDER SPECIFIED SYSTEMS OF PRODUCTION

Labor on purchased feeders is confined to the winter and spring months, thus avoiding a conflict with work on crops. A baby-beef unit uses more labor than purchased feeders during the winter season without introducing any serious conflict with crop work in the summer. A milk-and-beef unit uses an even larger amount of labor, but a larger proportion of the work must be performed during the cropping season.

of higher quality. If the supply of feed grains is relatively small, it may be desirable to curtail the size of the hog enterprise to something less than the optimum size in order that the most profitable rations for the beef cattle may be available. If the surplus of fattening grains is large and a normal relationship exists between the prices of hogs and cattle, it usually will be good economy to keep not more than 25 sows. Beyond this size of hog enterprise, cattle are likely to have a comparative advantage in the use of fattening grains and the regular labor supply.

Table 10. Standard Amounts of Labor, Capital, and Feed Used by Beef-Cattle Herd Units, Classified According to System of Production*

System of Production	Production per animal	Man labor per unit	Capital investment per unit‡	Feed per unit, exclusive of milk†			
				Farm-grown concentrates	Commercial protein supplement	Dry roughage	Bluegrass pasture
		hours	dollars	pounds	pounds	pounds	acres
Purchased-feeder unit							
40 yearlings	400 lb. gain	368	2,210	96,000	12,000	40,000	.....
40 two-year-olds	340 lb. gain	313	2,970	95,200	12,240	44,200	.....
Building and equipment		.....	560	.....	.....	.....	.....
Total (yearlings)		368	2,770	96,000	12,000	40,000	.....
Total (two-year-olds)		313	3,530	95,200	12,240	44,200	.....
Baby-beef unit§							
33 beef cows	400 lb. gain (calf)	1,020	2,508	4,000	.....	99,000	66.0
25 baby beeves	500 lb. gain	288	.....	65,625	7,500	25,000	.....
4 yearling heifers	350 lb. gain	32	229	1,200	.....	5,600	4.0
4 heifer calves	500 lb. gain	32	81	800	.....	2,900	2.0
1 beef bull		30	126	750	.....	3,000	.....
Building and equipment		.....	1,202	.....	.....	.....	.....
Total		1,402	4,146	73,375	7,500	135,500	74.0
Milk-and-beef unit¶							
20 milk-and-beef cows	160 lb. butterfat	2,200	1,280	20,000	.....	75,000	30.0
15 feeder calves and yearlings	450 lb. gain	155	.....	37,680	4,500	15,000	.....
15 beef calves	475 lb. gain	180	575	5,625	.....	10,875	15.0
3 yearling heifers	350 lb. gain	36	138	600	.....	4,800	3.6
3 heifer calves	500 lb. gain	24	60	1,125	.....	2,175	1.5
1 beef bull		30	114	750	.....	3,000	2.0
Building and equipment		.....	1,072	.....	.....	.....	.....
Total		2,625	3,239	65,280	4,500	110,859	52.1

* Adapted from data presented in table 8, Minn. Agri. Expt. Sta. Bull. 301, Beef Cattle Production in Minnesota. 1934.

† For a period of one year for breeding stock, and for the gain in weight indicated for fattening animals. The gains approach the upper limit of the usual range in order to indicate the maximum quantities of feed needed.

‡ Unit livestock values are 1929-1932 average March 1 inventory values of breeding stock and purchase value of feeding cattle bought on farms in Rock and Nobles counties. Investment in shelter and equipment is average per farm value of structures and equipment used by beef cattle.

§ Assumes one heifer a year per approximately 8 cows for replacements and 12 per cent death loss. Four cows would be milked.

¶ Assumes one heifer a year per approximately 7 cows for replacements and 10 per cent death loss; that cows freshen both spring and fall, providing a lot of feeder calves a part of which would be yearlings. All of the cows would be milked.

The system of production of beef cattle should be adjusted to the feed, labor, equipment, and capital available for investment on the particular farm. One of the three systems of production briefly described on page 14—purchased feeders, baby-beef, milk-and-beef—should be adopted. The data in table 10 and figure 7 indicate the principal advantages and disadvantages of each of the three systems in the use of different combinations of feed, labor, equipment, and working capital resources. Purchased feeder cattle utilize a maximum quantity of farm-grown concentrates proportionately to roughages and labor. They require a minimum of investment in shelter and equipment. Labor on purchased cattle is confined almost entirely to the winter and spring months, thus avoiding conflict with work on crops. Pasture is not essential and in this area is seldom used in fattening purchased cattle.

The system of beef-cattle production in which the feeders are purchased is therefore well suited to the farm that is wholly tillable. A baby-beef herd, on the other hand, provides the maximum utilization of a combination of concentrates, roughages, pasture, and winter labor. A milk-and-beef herd of approximately 20 cows uses quantities of concentrates and roughages approximately equal to those used by a baby-beef herd of about 30 cows, but in using these quantities of feed it uses fewer acres of pasture. The principal difference, however, between the two systems of production is in the labor demands of the two systems. If all the cows are milked, the milk-and-beef herd uses approximately twice as much labor as the baby-beef herd. A much larger proportion of the work must be performed during the cropping season. This is not always a handicap to this system of production, however, as it is usually selected by farmers on relatively small farms or by farmers who have a relatively large supply of regularly employed labor, usually family labor.

The milk-and-beef system of production has the additional advantage in that two products are produced for sale. Because of this feature it has considerable flexibility. The emphasis can be shifted readily either to the production of beef animals or to dairy products, depending upon the market situation for the two products.

Each of the other two systems of beef-cattle production has considerable flexibility in the matter of adjusting the use of feeds to price fluctuations. This is particularly true of the system of fattening purchased feeders. The feeds used on a farm following the system of fattening purchased feeders and hogs are of a kind that is largely marketable. Thus the operator has the alternative of either feeding on the farm the feeds produced

there or marketing them directly. Both the purchased-feeder enterprise and the hog enterprise can be reduced in size or completely closed out and re-entered without delay in response to changes in the relationships between the prices of cash grains on the one hand and the prices of beef cattle and hogs on the other. The beef-cattle-corn and the hog-corn price ratios are widely used in studying these relationships.

These ratios express numerically a comparison between the market value of the quantity of corn or its equivalent that may reasonably be expected to be used in producing 100 pounds of gain on beef cattle or 100 pounds of hogs and the value of the 100 pounds of beef cattle or hogs. When the market value of the estimated quantity of corn is high relative to the prospective value of the meat animals and quantity of corn or its equivalent will produce, it may be more profitable to market the feeds directly. On the other hand, when the value of the feed is low relative to the prospective value of the meat animals, a profit may be expected from using the feeds for fattening cattle and hogs.

The probable direction of the movement of beef-cattle prices, also, should be considered in this connection. Feeders of beef cattle usually cannot expect to obtain a profit on their operations unless they receive for the fat cattle a price that exceeds the market price of the feeders at the time they went into the feed lot. A downward movement in beef-cattle prices during the feeding period tends to eliminate the opportunity for obtaining a margin, whereas an upward movement tends to widen the spread between the prices of thin and fat cattle.

The margin necessary for a profit in the feeding operations is influenced by the cattle-corn price ratio, the age and quality of the cattle fattened, the rations fed, and the skill of the feeder in obtaining economical gains from the feeds used. Obviously, the higher the cattle-corn ratio (the cheaper corn is with reference to beef cattle), the lower the margin necessary to break even. In general, a margin of two cents a pound is sufficient to insure a reasonable profit.

Having considered the choice of a system of beef-cattle production, considerable thought should be given next to production practices. The management of beef cattle is discussed in several Minnesota bulletins.[6] Such subjects as the importance of well-bred animals, the selection of rations, the economical type of shelter, the kind of feeders to buy and the time to purchase

[6] Minn. Agri. Expt. Sta. Bull. 300, Selection and Purchase of Feeders and Rations for Fattening Beef Cattle, by W. H. Peters; Minn. Agri. Expt. Sta. Bull. 301, Beef Cattle Production in Minnesota, by C. W. Crickman, G. A. Sallee, and W. H. Peters; and Minn. Agri. Ext. Bull. 146, Beef Production, by W. H. Peters and W. E. Morris.

them, and the time to sell the fat cattle are discussed in these bulletins. The recommendations made in these bulletins may serve as a guide in the management of the beef-cattle enterprise.

BUDGETS FOR THREE BEEF-CATTLE FARMS IN SOUTHWESTERN MINNESOTA

The purpose of this section is primarily to illustrate the budget method of planning and to estimate the probable advantages in increased returns of a closer adjustment of the farming system to the farmer's productive resources in the manner already described. Budgets are set up for three farms. Each of these three farms is well adapted to one of the systems of beef-cattle production described on pages 14 to 17. These farms are typical of

Table 11. Distribution of Acreage and the Production and Disposal of Crops (Present Organization, Farm 1)

Crop	Acres	Yield per acre	Total production	Disposal		
				Seed	Feed	Sales
Tillable land						
Corn, husked	69	35 bu.	2,415 bu.	12 bu.*	1,536 bu.	867 bu.
Corn, silage	9	6.8 tons	61 tons	.....	61 tons	.....
Oats	46	41 bu.	1,886 bu.	138 bu.	940 bu.	808 bu.
Barley	8	33 bu.	264 bu.	24 bu.	240 bu.	.....
Alfalfa hay	16	2.0 tons	32 tons	.....	25.4 tons	6.6 tons
Timothy and clover hay	6	1.1 tons	6.6 tons	.....	6.6 tons	.....
Sweet-clover pasture	7	pasture	.....	.....	.....	.....
Bluegrass pasture	20	pasture				
Total tillable land	181					
Nontillable land						
Wild hay	6	.9 ton	5.4 tons	.....	5.4 tons	.....
Native pasture	12	pasture				
Farmstead, road, etc.	25					
Total all land	224					

* Includes seed for silage corn.

many farms throughout southwestern Minnesota. Hence, the adjustments here suggested, if put into practice, probably would increase the returns from a great many farms. It must be recognized, however, that since no two farmers' resources are exactly alike and any plans for the reorganization of different farms must take into consideration their differences, the suggestions are intended merely as a guide to the farmer working with his own problem of reorganization. The application of the method of planning to other farms than these selected will be discussed in a following section.

In presenting the organization of the three farms, normal or average crop yields, livestock production, and production re-

Table 12. Normal Amounts of Materials and Contract Services Used in Crop Production, Farm 1

Crop	Materials per Acre		Contract Services	
	Kind	Quantity	Kind	Cost
Corn	Seed { grain	8 lb.	Ensilage cutter and power, per acre	$3.00
	Seed { silage	16 lb.		
	Twine	4.5 lb.		
Oats	Seed	3 bu.	Threshing, bu.	.02½
	Twine	3.2 lb.		
Barley	Seed	3 bu.	Threshing, bu.	.04
	Twine	3.0 lb.		
Alfalfa hay	Seed	10 lb.		
Sweet clover	Seed	12 lb.		
Red clover*	Seed	8 lb.		
Timothy*	Seed	6 lb.		

* Timothy and clover seeded together.

quirements for the particular farm have been substituted for actual yields of any one year of record in order to average the effect of seasonal variations.

Organizing the Farm for Milk-and-Beef Production

Present Organization

The farm selected for the first illustration of the method of planning the organization of the farm business and budgeting receipts and expenses is one which is well adapted to considerable specialization in milk-and-beef production. The resources of this farm (farm 1) are as follows:

INVENTORY OF PRESENT RESOURCES

	Acres
Real estate	
Total tillable land	181
Nontillable land	18
Farmstead, road, and waste	25
Total	224

Labor supply
- The operator's labor for the entire year
- One hired laborer for the entire year
- The assistance of the operator's wife in chores and care of the chickens
- Day labor as needed

Power and equipment
- Five work horses
- All machinery necessary for the crops grown

The farm is equipped with buildings adequate to care for 5 work horses, 15 cows, 20 young stock, 12 brood sows and their pigs, and a poultry flock averaging 100 hens.

The acreage, production, and distribution of crops grown under the present organization are shown in table 11.

The normal amounts of materials and contract services used per acre of crops on this farm are given in table 12.

The number of livestock and the production of livestock and livestock products are shown in table 13.

The normal amounts of feed, labor, materials, and services used per head or per one hundred pounds gain in livestock production on this farm are presented in table 14.

Table 13. Number, Production, and Disposal of Livestock and Livestock Products (Present Organization, Farm 1)

Class of livestock		Production			Disposal		
		Kind	Unit	Amount	Fed to livestock	Used	Sold
Milk-and-beef cows	13 head	2 cull cows	lb.	2,200	.....	.....	2,200
		Butterfat	lb.	2,340	65	170	2,105
		Skim milk	lb.	54,810	54,560	250	.....
Bull	1 head	.....	.....	.....	.....	.....	.....
Fattening cattle	10 head	Cattle	lb.	8,000	.....	700	7,300
Other cattle	14 head	.....	.....	.....	.....	.....	.....
Hogs	12 sows	Marketable hogs	lb.	14,000	.....	425	13,575
Chickens	80 hens	Chickens	lb.	1,200	.....	330	870
		Eggs	doz.	533	.....	150	383

These normal expenditures in crop and livestock production were determined after giving consideration to the conditions peculiar to this farm, the results obtained on it during the three-year study, the characteristics of the operator, and the previously suggested standards for the area. Because of existing conditions, these normal amounts may vary from the area standards.

A summary of the total amounts of feed, labor, and materials used in livestock production with the present organization is given in table 15.

The distribution of man labor by weeks on this farm with the present organization and the available regular labor supply are shown in figure 8.

A summary of the sales and expenses, including only those which are affected by changes in organization, is given in table 16. On the basis of the quantities available for sale as shown in tables 11 and 13 and the prices as given in table 7, the return above expenses which vary with changes in organization amounts to $2,303. It should be noted that interest on investment, taxes, and depreciation have not been included in the statement.

Table 14. Normal Amounts of Feed, Labor, Materials, and Services Used in Livestock Production, Farm 1

Class of livestock	Unit	Corn	Oats	Barley	Linseed meal	Meat scrap	Legume hay	Other hay	Silage	Milk	Skim milk	Pasture	Man labor	Horse work	Veterinary, medicine, salt, etc.
		pound	pound	pound	pound	pound	pound	pound	pound	pound	pound	acres	hour	hour	dollar
Work horse	1 head	.....	3,650	.....	.....	.....	3,500	3,000	.....	.....	.....	.50	80.0	.....	1.00
Milk-and-beef cow	1 head	1,400	100	.....	.....	.....	1,900	600	6,000	.....	.....	1.50	140.0	.5	.50
Bull	1 head	400	500	.....	.....	.....	1,500	.....	5,000	.....	.....	1.50	30.0	.5	.20
Young stock—first year	1 head	400	400	.....	.....	.....	300	.....	1,000	150	2,500	.75	35.0	.5	.30
Young stock—second year	1 head	400	400	.....	.....	.....	200	.....	1,350	.....	.....	1.25	25.0	.5	.30
Fattening cattle (present)	cwt. gain	800	.....	.....	.....	.....	165	60	1,200	.....	.....	.....	4.0	.2	.02
(suggested)*	cwt. gain	400	10	180	65	.....	400	.....	.....	.....	.....	.....	3.0	.2	.02
Hogs (present)	cwt. gain	310	20	70	.....	.....	.....	.....	.....	.....	160	.03	3.2	.2	.25
(suggested)*	cwt. gain	290	20	65	.....	.....	.....	.....	.....	.....	160	.03	3.2	.2	.25
Chickens	100 hens	3,000	2,000	1,980	.....	400	.....	.....	.....	.....	2,700	.....	28.0	.5	3.50

* See text for discussion of present and suggested rations.

Table 15. Utilization of Feed, Labor, Materials, and Services in Livestock Production (Present Organization, Farm 1)

Class of livestock	Number of units	Corn	Oats	Barley	Meat scrap	Legume hay	Other hay	Silage	Milk	Skim milk	Pasture	Man labor	Horse work	Veterinary, medicine, salt, etc.
		bushel	bushel	bushel	pound	ton	ton	ton	pound	pound	acres	hour	hour	dollar
Work horses	5 head	.....	570	.....	.....	8.8	7.5	.....	.....	.....	1.5	400	.....	5.00
Milk-and-beef cows	13 head	325	41	.....	.....	12.4	3.9	39.0	.....	.....	19.5	1,820	6.5	6.50
Bull	1 head	7	16	.....	.....	.8	.....	2.5	.....	.....	1.5	30	.5	.20
Other cattle	14 head	100	175	.....	.....	1.8	.....	8.3	1,800	30,000	14.0	420	7.0	4.20
Fattening cattle	2,000 lb. gain	286	.....	.....	.....	1.6	.6	12.0	.....	.....	.....	80	4.0	.40
Hogs	14,000 lb. gain	775	88	204	.....	.....	.....	.....	.....	22,400	4.2	448	28.0	35.00
Chickens	80 hens	43	50	33	320	.....	.....	.....	.....	2,160	.....	224	.4	2.80
Total		1,536	940	237	320	25.4	12.0	61.8	1,800	54,560	40.7	3,422	62.4	54.10

Suggestions for Reorganization

A study of the organization and operation of this farm reveals the possibility of making several changes which should materially increase the operator's net income.

Crop yields on this farm are lower than the average for the area. This suggests the advisability of increasing the proportion of the acreage in legumes and increasing livestock production in order to utilize the additional roughage produced as well as grain

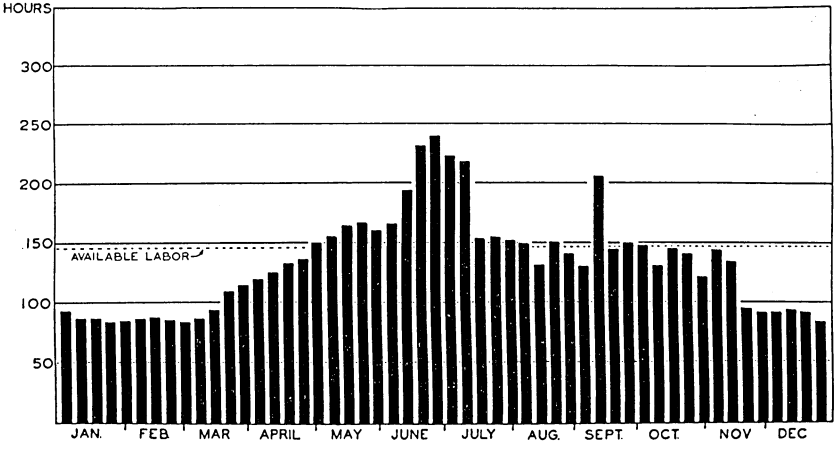

FIG. 8. DISTRIBUTION OF MAN LABOR BY WEEKS ON A FARM ADAPTED TO MILK-AND-BEEF PRODUCTION WITH THE PRESENT ORGANIZATION

The present organization requires the hiring of day labor during the summer and does not provide sufficient work during the winter months.

which is being sold. Sweet-clover pasture should be substituted for the native pasture now growing on tillable land.

An increase in legumes would provide for an improvement in the quality of the rations being fed to livestock and should result in more economical production.

Under the present system of management of fattening cattle, the daily ration contains too much silage and too little grain. As a result, the feeding period is unduly prolonged. Furthermore, the gain per day and per unit of labor and feed is small. An increase in the daily feed, the use of alfalfa hay as the sole roughage, and the inclusion of linseed meal in the ration may reasonably be expected to result in more rapid and more economical gains.

The only pasture provided for hogs is bluegrass pasture. An increase in legumes would permit the use of alfalfa pasture for growing pigs. The adoption of fall farrowing with part of the sows would permit more efficient utilization of skim milk and labor during the fall and winter months.

Table 16. Normal Returns with Present Organization (Farm 1)*

	Amount	Price	Value		
Crop sales					
Corn	867 bu.	at $ .45	$390		
Oats	808 bu.	at .27	218		
Alfalfa	6.6 ton	at 10.00	66		
Total crop sales				$ 674	
Livestock and livestock product sales					
Butterfat	2,105 lb.	at .27	568		
Cows	2,200 lb.	at .0375	83		
Cattle	7,300 lb.	at .075	548		
Hogs	13,575 lb.	at .065	882		
Chickens	870 lb.	at .10	87		
Eggs	383 doz.	at .18	69		
Total livestock and livestock product sales				2,237	
Total crop and livestock sales					$2,911
Crop expenses					
Alfalfa seed	53 lb.	at .20	11		
Clover seed	48 lb.	at .20	10		
Sweet clover seed	84 lb.	at .06	5		
Timothy seed	36 lb.	at .07	3		
Twine	209 lb.	at .08	17		
Threshing			58		
Ensilage cutter and power			27		
Total crop expense				131	
Livestock and feed expenses					
Baby chicks	200	at .06	12		
Meat scrap	240 lb.	at .025	6		
Veterinary, medicine, salt, etc.			54		
Total livestock expense				72	
Other expenses					
Hired labor, month	12 mo.	at 30.00	360		
Hired labor, day	30 days	at 1.50	45		
Total other expenses				405	
Total crop, livestock, and other expenses					608
Returns above expenses which vary with changes in organization					$2,303

* Only receipts and expenses which are affected by changes in organization are considered here.

As previously indicated, there is not enough work to keep the regular labor supply fully occupied during the winter months. An increase in livestock would provide additional work during the winter and provide manure for building up the productivity of the land.

It is suggested, therefore, that the acreage of corn and oats be reduced, the acreage of alfalfa and barley increased, and that sweet clover be used for pasture on tillable land. In order to feed all of the crops raised, it is suggested that the number of

cows be increased to 20, that 5 of the 12 sows raise fall as well as spring litters, and that the poultry flock be increased to 100 hens. In addition, it is suggested that silage and nonlegume hay be eliminated and linseed meal added to the ration for fattening cattle and that full feeding be practiced. Also, it is suggested that alfalfa pasture be provided for hogs.

The distribution of acreage and the production and disposal of crops suggested to effect these changes in the cropping system are shown in table 17. The crop land is divided into seven fields of 21 acres each and four fields of eight acres each for a minor rotation.

To get legumes on all of the land as quickly as possible, three of the large fields would be used in a rotation of corn, oats, and alfalfa, with the alfalfa remaining down for three years. Sweet clover would be planted in the oats as a green-manure crop to be plowed under the following spring, except in the year alfalfa is seeded. The other four large fields would be used for a rotation of corn, corn, barley, and sweet-clover pasture. The four small fields in the minor rotation would be used in a rotation of corn, oats, alfalfa hay, and alfalfa pasture for hogs.

The suggested numbers of livestock and the estimated production and disposal of livestock and livestock products are shown in table 18. The data on butterfat production are based upon the assumption of no change in production per cow, although some increase might be expected to result from the substitution

Table 17. Distribution of Acreage and the Production and Disposal of Crops (Suggested Organization, Farm 1)

	Acres	Yield per Acre		Total production	Disposal		
		Unit	Amount		Seed	Feed	Sales
Tillable land							
Corn, husked	60	bu.	35.0	2,100	12*	2,088	.....
Corn, silage	11	ton	6.8	75	.....	75	.....
Oats	29	bu.	41.0	1,189	87	1,102	.....
Barley	21	bu.	33.0	693	63	630	.....
Alfalfa hay	29	ton	2.0	58	.....	55	3
Alfalfa, pasture	8		.....	.....	.....	.....	.....
Sweet clover, pasture	21		.....	.....	.....	.....	.....
Total tillable land	179						
Nontillable land							
Wild hay	6	ton	.9	5.4	.....	5.4	.....
Native pasture	12		.....	.....	.....	.....	.....
Farmstead, road, etc.	27		.....	.....	.....	.....	.....
Total all land	224						

* Includes seed for silage corn.

of sweet clover for bluegrass pasture and of alfalfa for clover and timothy hay. The amounts of products used have been adjusted to allow for the board of additional hired laborers.

The amounts of feed used with the suggested livestock organization are summarized in table 19. These amounts are based on the unit data given in table 14. It is assumed that the change in available feeds resulting from the proposed reorganization of

Table 18. Number, Production, and Disposal of Livestock and Livestock Products (Suggested Organization, Farm 1)

Kind	Number	Production			Disposal		
		Kind	Unit	Amount	Fed to livestock	Used*	Sold
Milk-and-beef cows	20 head	3 cull cows	lb.	3,300	.....	.....	3,300
		Butterfat	lb.	3,600	97	180	3,323
		Skim milk	lb.	82,180	81,910	270	.....
Bull	1 head	.....	.....	.....	.....	.....	.....
Fattening cattle	15 head	Cattle	lb.	13,875	.....	745	13,130
Other cattle	21 head	.....	.....	.....	.....	.....	.....
Hogs	12 sows	Marketable hogs	lb.	20,000	.....	450	19,550
Chickens	100 hens	Chickens	lb.	1,500	.....	355	1,145
		Eggs	doz.	675	.....	160	515

* Amounts increased to allow for board of additional hired labor.

the cropping system and the adoption of the suggested changes in feeding practices will make possible the fattening of cattle and the production of hogs with the rations suggested in table 14. In balancing the feed needed for livestock with the production of crops, it was necessary to substitute one kind of feed for another in order to make the best use of the feeds produced. In no case, however, were the quantities of feed involved large enough to result in any material change in the ration.

The distribution of labor by weeks with the suggested organization is shown in figure 9. Because of the increased amount of livestock, the amount of work to be done during the growing season is sufficient to require the hiring of one additional laborer for a period of four months. The available labor supply, including this additional laborer, is also indicated in figure 9.

The harvesting of the first cutting of alfalfa competes with corn cultivating for labor and with the large acreage of corn and alfalfa. The demand for labor exceeds the regular supply at that time. It is assumed, however, that the extra demands will be met by a temporary increase in the number of hours worked per day or by the use of exchange labor.

Silo filling is another operation which demands a large amount of labor during a relatively short period as shown by the labor peak in September. But here again the demands usually are met by exchanging work with neighbors.

Table 19. Utilization of Feed, Labor, Materials, and Services in Livestock Production (Suggested Organization, Farm 1)

Class of livestock	Number of units	Corn	Oats	Barley	Meat scrap	Linseed meal	Legume hay	Other hay	Silage	Milk	Skim milk	Pasture	Man labor	Horse work	Veterinary, Medicine, etc.
		bushel	bushel	bushel	pound	pound	ton	ton	pound	pound	pound	acre	hour	hour	dollar
Work horses	5 head	.....	570	.....	.....	.....	10.9	5.4	.....	.....	.....	1.5	400	.....	5.00
Milk-and-beef cows	20 head	470	63	.....	.....	.....	26.5	.....	60	.....	.....	20.0	2,800	10.0	10.00
Bull	1 head	7	16	.....	.....	.....	.8	.....	2	.....	.....	1.5	30	.5	.20
Calves, 1st year	18 head	129	225	.....	.....	.....	2.7	.....	9	2,700	45,000	13.50	630	9.0	5.40
Heifers, 2nd year	3 head	21	22	.....	.....	.....	.7	.....	2	.....	.....	3.75	75	1.5	.90
Fattening cattle	6,000 lb. gain	429	19	225	.....	3,900	12.0	.....	.....	.....	.....	.....	180	12.0	1.20
Hogs	20,000 lb. gain	978	125	363	.....	.....	.....	.....	.....	.....	32,000	6.00	640	40.0	50.00
Chickens	100 laying hens	54	62	42	400	.....	.....	.....	.....	.....	2,700	.....	280	.5	3.50
Total*	.....	2,088	1,102	630	400	3,900	53.6	5.4	73	2,700	79,700	46.25	5,035	73.5	76.20

* The total amounts of feeds are based upon the normal amounts presented in table 14. However, in order to make the best use of the feeds produced, one kind of feed has been substituted for another in certain cases. These substitutions were made on the following basis: 1 pound of oats for .9 pounds of corn; 1 pound of barley for .95 pound of corn; 1 pound of alfalfa hay for 3 pounds of silage; 1 pound of alfalfa hay for .6 pound of corn; and 17 pounds of skim milk for 1 pound of meat scraps.

The estimated sales and expenses for the suggested organization are shown in table 20. The reader is reminded again that only the items affected by the change in organization are included and therefore this statement is not to be construed as a statement of total net income.

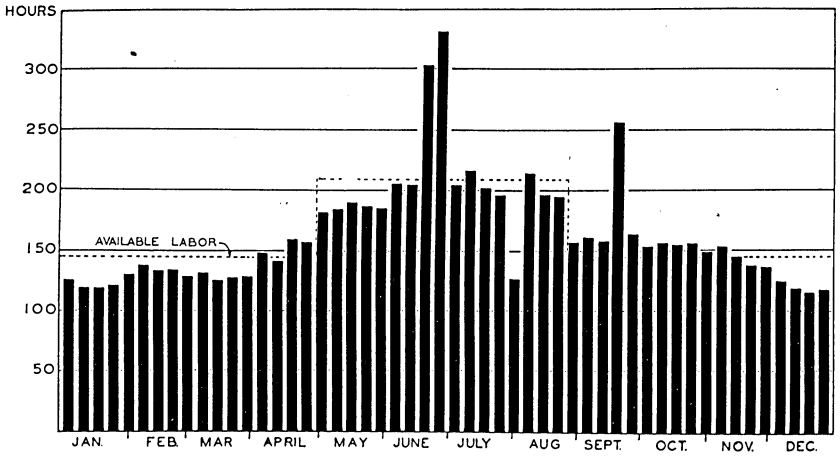

FIG. 9. DISTRIBUTION OF MAN LABOR BY WEEKS ON A FARM ADAPTED TO MILK-AND-BEEF PRODUCTION WITH THE SUGGESTED ORGANIZATION

The suggested organization requires the hiring of an additional laborer for four months and provides for reasonably complete utilization of the labor of the regular workers throughout the year.

The increase in livestock makes necessary the addition of a cattle shed approximately 20 by 40 feet in size and the construction of additional bunks and feeding racks. Depreciation, taxes, and interest on the additional investment have been included in the statement. Likewise, interest on the additional investment in the livestock has been included as an expense.

The suggested organization, according to the estimated sales and expenses, has an advantage in returns over the present organization of $400 per year. After the suggested plan has been in operation long enough for the benefits from the improved rotation and the feeding of all crops to be reflected in increased crop yields, it seems reasonable to expect yields approximately 15 per cent greater than those being obtained at the present time. These increased yields, on the basis of normal prices, would add approximately $335 annually to the income without an increase in expenses other than the cost of the additional labor needed to harvest the larger yield. Thus, the suggested plan of organization and operation provides (*a*) an eventual increase in annual income of over 30 per cent, (*b*) a high degree of conservation and improvement of the natural resources of the farm, and (*c*) greater security for the capital invested.

Table 20. Normal Returns with Suggested Organization for Milk-and-Beef Production (Farm 1)

	Amount	Price	Value		
Crop sales					
Alfalfa	3 tons	at $10.00	$ 30		
Total crop sales				$ 30	
Livestock and livestock product sales					
Butterfat	3,323 lb.	at .27	897		
Cows	3,300 lb.	at .0375	124		
Cattle	13,130 lb.	at .075	985		
Hogs	19,550 lb.	at .065	1,271		
Chickens	1,145 lb.	at .10	115		
Eggs	515 doz.	at .18	93		
Total livestock and livestock product receipts				3,485	
Total crop and livestock receipts					$3,515
Crop expenses					
Alfalfa seed	150 lb.	at .20	30		
Sweet clover seed	420 lb.	at .06	25		
Twine	206 lb.	at .08	16		
Threshing			57		
Ensilage cutter and power			33		
Total crop expense				161	
Livestock and feed expenses					
Baby chicks	250	at .06	15		
Meat scrap	400	at .025	10		
Veterinary, medicine, salt, etc.			76		
Total livestock and feed expense				101	
Other expenses					
Hired labor	16 mo.	at 30.00	480		
Interest, depreciation and taxes on additional buildings and equipment			40		
Interest on additional investment in livestock			30		
Total other expenses				550	
Total crop, livestock, and other expenses					812
Return above expenses which vary with changes in organization					2,703
Probable difference in returns in favor of suggested organization					$ 400

Organizing the Farm for Baby-Beef Production

Present Organization

There are many farms in this area that have a considerable acreage of land which because of soil type, topography, or lack of drainage is not suited to cultivation. On such farms, a beef-breeding herd is one means of utilizing the hay and pasture to advantage.

One of the farms included in the three-year study is such a farm. The inventory of resources on this farm (farm 2) is as follows:

INVENTORY OF PRESENT RESOURCES

	Acres
Real estate	
Tillable crop land	262
Nontillable hay and pasture	122
Farmstead, road, and waste	34
Total	418
Labor supply	
The operator's labor for the entire year	
The assistance of the operator's wife and one young son in caring for the chickens and in doing chores.	
One hired laborer for eight months	
Power and equipment	
Nine work horses	
All machinery and equipment needed for producing the crops grown	

This farm is equipped with buildings adequate to house 10 work horses, 18 cows, 47 other cattle, 12 sows and their pigs, and 100 hens.

The distribution of acreage and the production and disposal of crops under the present organization are shown in table 21. The production is based on normal yields for this farm.

The normal amounts of materials and contract services used in crop production are given in table 22.

The numbers of livestock and the production and disposition of livestock and livestock products are shown in table 23.

The amounts of feed, labor, materials, and services used per head or per unit of production for livestock are presented in table 24. These amounts are based upon the feeds available and the results obtained on this farm during the three-year study, except in the case of those for beef-breeding cows and fattening calves. These latter are based on standards for the area adjusted on the assumption that the operator will be able to develop the same degree of efficiency in handling these as he has shown in handling the other classes of livestock.

The total annual feed, labor, and cash expenses for veterinarian, medicine, and salt are summarized for each class of livestock in table 25.

The distribution of man labor by weeks with the present organization is shown in figure 10. As may be seen, there is more work during eight months of the year than the operator can do with the available family help but not enough to utilize completely the labor of an additional worker, except during the har-

Table 21. Distribution of Acreage and Production and Disposal of Crops (Present Organization, Farm 2)

Crop	Acres	Production			Disposal		
		Unit	Per acre	Total	Seed	Feed	Sales
Tillable land							
Corn, husked	111	bu.	37	4,107	19*	1,475	2,613
Corn, fodder	5	ton	2.3	11.5	.....	11.5	.....
Barley	63	bu.	34	2,142	126	750	1,266
Oats	79	bu.	41	3,239	198	1,332	1,709
Pasture	4	hog pasture		.....	.....	.....	.....
Wild hay	4	ton	1.0	4	.....	4	.....
Nontillable land							
Wild hay	57	ton	1.0	57	.....	57	.....
Native pasture	61						
Farmstead, road, waste, etc.	34						
Total all land	418						

* Includes seed for fodder corn.

Table 22. Normal Amounts of Materials and Contract Services Used in Crop Production, Farm 2

Crop	Materials per Acre		Contract Services	
	Kind	Quantity	Kind	Cost
Corn, husked	Seed	.14 bu.	.....	.....
Corn, fodder	Seed	.30 bu.	.....	.....
	Twine	5 lb.	.....	.....
Barley	Seed	2.3 bu.	Threshing, bu.	$0.04
	Twine	3.0 lb.	.....	.....
Oats	Seed	3.0 bu.	Threshing, bu.	.02½
	Twine	3.2 lb.	.....	.....
Sweet clover	Seed	10 lb.	.....	.....
Alfalfa	Seed	12 lb.	.....	.....

Table 23. Number, Production, and Disposal of Livestock and Livestock Products (Present Organization, Farm 2)

Class of livestock	Number	Production			Disposal		
		Kind	Unit	Amount	Fed to livestock	Used	Sold
Milk-and-beef cows	16 head	3 cull cows	lb.	3,150	.....	.....	3,150
		Butterfat	lb.	2,560	84	245	2,231
		Skim milk	lb.	56,120	56,120	.....	.....
Bull	1 head	.....	.....	.....	.....	.....	750*
Fattening cattle	12 head	Cattle	lb.	10,200	.....	700	9,500
Other cattle	18 head	.....	.....	.....	.....	.....	.....
Hogs	12 sows	Marketable hogs	lb.	16,175	.....	750	15,425
Chickens	80 hens	Chickens	lb.	120	.....	120	.....
		Eggs	doz.	273	.....	93†	180

* One bull sold every two years.
† Includes 17 dozen set for hatching.

Table 24. Normal Amounts of Feed, Labor, Materials, and Services Used in Livestock Production, Farm 2

Class of livestock	Unit	Corn	Small grain	Linseed meal	Hay and fodder	Milk	Skim milk	Native pasture	Man labor	Horse work	Vet., med., salt, etc.
		pound	pound	pound	pound	pound	pound	acre	hour	hour	dollar
Work horse	1 head	.....	3,200	.....	5,000	.....	.....	1.00	55.0	.....	.50
Milk-and-beef cow	1 head	525	525	.....	3,900	.....	.....	1.50	115.0	4.2	.21
Heifer calf (milk-and-beef)	1 head	.....	395	.....	800	150	2,000	.50	13.0	2.1	.07
Yearling heifer (milk-and-beef)	1 head	.....	210	.....	1,700	.....	.....	1.20	8.0	2.1	.07
Beef cow*	1 head	.....	320	.....	3,000	.....	.....	1.50	21.0	3.1	.21
Heifer calf (beef)*	1 head	.....	315	.....	750	Nurse	.....	.50	8.4	1.0	.04
Yearling heifer (beef)*	1 head	.....	210	.....	1,700	.....	.....	1.20	8.4	1.0	.04
Bull	1 head	265	500	.....	3,200	.....	.....	2.00	31.5	1.0	.21
Nursed calves (beef)*	1 head	.....	.....	.....	.....	.....	.....	.50	8.4	1.0	.04
Fattening cattle, calf*	100 lb.	425	150	50	210†	.....	.....	.....	2.4	.7	.02
Fattening cattle, yearling	100 lb.	450	250	100	300‡	.....	.....	.....	2.4	.7	.02
Hogs	100 lb.	300	120	.....	.....	.....	160	.025	1.6	.3	.16
Chickens	100 hens	1,300	1,800	.....	.....	.....	300	.....	190.0	.....	10.00

* Estimated from standards for the area assuming the same relative efficiency of production as with other livestock. Amounts indicated for fattening cattle are for gains while in the feed lot.

† Estimated on the basis of alfalfa hay being the only roughage.

‡ Estimated on the basis of wild hay constituting the principal roughage.

Table 25. Amounts of Feed, Labor, Materials, and Services Used in Livestock Production (Present Organization, Farm 2)

Class of livestock	Units	Corn	Oats	Barley	Linseed meal	Hay and fodder	Milk	Skim milk	Pasture	Man labor	Horse work	Vet., med., salt, etc.
		bushel	bushel	bushel	pound	ton	pound	pound	acre	hour	hour	dollar
Work horses	9 head	.....	900	.....	.....	22.5	.....	.....	9.00	495	.....	4.50
Milk-and-beef cows	16 head	150	138	83	.....	31.2	.....	.....	24.00	1,840	67	3.36
Bull	1 head	5	16	.....	.....	1.6	.....	.....	2.00	31	1	.21
Calves	15 head	.....	136	33	.....	6.0	2,250	30,000	7.50	195	32	1.05
Yearling heifers	3 head	.....	10	7	.....	2.6	.....	.....	3.60	24	6	.21
Fattening cattle	5,400 lb. gain	434	.....	281	5,400	8.1	.....	.....	.....	130	38	1.08
Hogs	16,175 lb. gain	867	101	337	.....	.....	.....	25,880	4.04	259	49	25.88
Chickens	80 hens	19	31	9	.....	.....	.....	240	.....	125	.....	8.00
Total		1,475	1,332	750	5,400	72.0	2,250	56,120	50.14	3,126	193	44.29

vesting of small grains. The extra labor required during grain harvesting can be provided by exchanging work with neighbors and by working more hours per day. The son can replace a man on some of the lighter tasks and thereby reduce the need for hiring additional laborers.

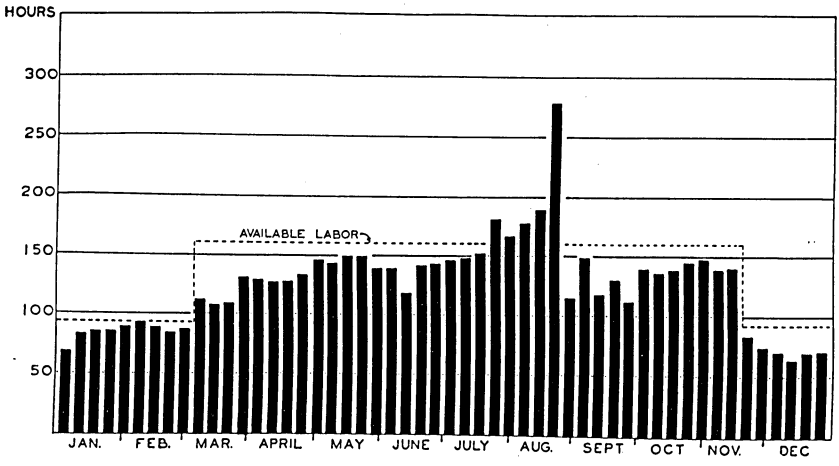

FIG. 10. DISTRIBUTION OF MAN LABOR BY WEEKS ON A FARM ADAPTED TO BABY-BEEF PRODUCTION WITH THE PRESENT ORGANIZATION

The present organization requires the hiring of an additional worker during the summer months, but fails to provide sufficient work to utilize fully the additional labor.

A summary of the sales and expenses which are affected by changes in the organization is presented for this farm in table 26. With the present organization, there is a return over the expenses affected by the change in organization of $4,113.

Suggestions for Reorganization

There are several respects in which the organization of this farm might be changed to advantage.

The large acreage of nontillable land available for hay or pasture and the large acreage of feed grains, particularly corn, together with a relatively small amount of family labor suggests the desirability of the establishment of a beef-breeding herd and the fattening of the calves as baby beeves. As previously pointed out, a cattle enterprise of this type provides for a maximum utilization of pasture and fattening grains with a minimum of labor. The breeding herd would provide for the utilization of the nontillable land as pasture and the fattening of baby beeves would provide a market for much of the corn produced. More-

over, baby-beef production would require relatively little labor during the growing season. An increase in the swine enterprise as a means of utilizing the surplus of corn and barley over that needed for the number of cattle, for which roughage can be provided, also seems desirable. By increasing the cattle and hogs, it should be possible to feed practically all of the crops produced on the farm, thereby retaining on the farm much of the fertilizing element otherwise removed in the crops sold.

The present cropping system does not provide for a legume or sod crop in the rotation. Although yields are near the average, they have started to decline and may be expected to decline more rapidly if the present cropping system is continued. Fur-

Table 26. Normal Returns with Present Organization (Farm 2)

Item	Amount		Price	Value		
Crop sales						
Corn	2,613 bu.	at	$.45	$1,176		
Barley	1,266 bu.	at	.55	696		
Oats	1,709 bu.	at	.27	461		
Total crop sales					$2,333	
Livestock and livestock product sales						
Cows	3,150 lb.	at	.0375	118		
Butterfat	2,231 lb.	at	.27	602		
Bull (one every two years)	750 lb.	at	.05	38		
Fat cattle	9,500 lb.	at	.075	712		
Hogs	15,425 lb.	at	.065	1,003		
Eggs	180 doz.	at	.18	32		
Total livestock and livestock product sales					2,505	
Total crop and livestock sales						$4,838
Crop expenses						
Threshing				167		
Twine	467 lb.	at	.08	37		
Total crop expense					204	
Livestock and feed expenses						
Bull (one purchased every 2 years)				75		
1 boar	150 lb.			25		
Linseed meal	5,400 lb.	at	.018	97		
Feed grinding	498 cwt.	at	.08	40		
Veterinary, medicine, salt, etc.				44		
Total livestock expense					281	
Other expenses						
Hired labor	8 mo.	at	30.00	240		
Total other expenses					240	
Total crop, livestock, and other expenses						725
Returns above expenses which vary with changes in organization						$4,113

Table 27. Distribution of Acreage and Production and Disposal of Crops (Suggested Organization, Farm 2)

Crop	Acres	Production			Disposal		
		Unit	Per acre	Total	Seed	Feed	Sales
Tillable land							
Corn	104	bu.	37	3,848	15	3,833	.....
Barley	49	bu.	34	1,666	113	1,553	.....
Oats	54	bu.	41	2,214	162	1,732	320
Alfalfa	49	ton	2	98	.....	98	.....
Alfalfa, hog pasture	10	ton	1*	10	.....	10	.....
Nontillable land							
Wild hay	15	ton	1	15	.....	15	.....
Native pasture	103	pasture					
Farmstead, road, etc.	34						
Total	418						

* One cutting of hay harvested.

thermore, the maintaining of soil tilth is becoming increasingly difficult. The inclusion of alfalfa in the rotation and the seeding of sweet clover in the small grain to be plowed under as a green-manure crop should increase yields, improve soil fertility, help to prevent soil erosion, and provide a high-quality roughage for livestock.

The suggested distribution of acreage and the production and distribution of crops are given in table 27. All but 15 acres of the nontillable land is used for pasture. The major rotation consists of five fields, two of corn and one each of barley, oats, and alfalfa. It is suggested that the alfalfa remain on one field for five years before being broken up. Sweet clover would be seeded in the oats and barley to be plowed under as a green-manure crop.

Table 28. Number, Production, and Disposal of Livestock and Livestock Products (Suggested Organization, Farm 2)

Kind	Number	Production			Disposal		
		Kind	Unit	Amount	Fed to livestock	Used	Sold
Milk-and-beef cows	4 head	1 cull cow	lb.	1,100	.....	.....	1,100
		Butterfat	lb.	640	22	248	370
		Skim milk	lb.	9,900	9,900	.....	.....
Beef-breeding cows	40 head	6 cull cows	lb.	6,600	.....	.....	6,600
Bulls	2 head	1 bull	lb.	1,500	.....	.....	1,500
Fattening cattle	41 head*	Cattle	lb.	37,900	.....	800	37,100
Other cattle	47 head	.....	.....	.....	.....	.....	.....
Hogs	30 sows	Marketable hogs	lb.	46,000†	.....	670	45,330
Chickens	80 hens	Chickens	lb.	120	.....	120	.....
		Eggs	doz.	273	.....	94‡	179

* Includes nine purchased feeder cattle.
† includes 1,000 pounds gain on hogs following fattening cattle.
‡ Includes 17 dozen used for setting.

Table 29. Amounts of Feed, Labor, Materials, and Services Used in Livestock Production (Suggested Organization, Farm 2)

Class of livestock	Number of units	Corn	Oats	Barley	Linseed meal	Tankage	Alfalfa hay	Wild hay	Milk	Skim milk	Pasture	Man labor	Horse work	Vet., med., salt, etc.
		bushel	bushel	bushel	pound	pound	ton	ton	pound	pound	acre	hour	hour	dollar
Work horses	9 head	.....	900	.....	.....	.....	7.5	15.0	.....	.....	9.00	495	.....	4.50
Milk-and-beef cows	4 head	38	35	21	.....	.....	7.8	.....	.....	.....	6.00	460	17	.84
Beef-breeding cows	40 head	.....	400	.....	.....	.....	60.0	.....	.....	.....	60.00	840	124	8.40
Bulls	2 head	9	32	.....	.....	.....	3.2	.....	.....	.....	4.00	63	2	.42
Milk-and-beef calves	4 head	.....	34	10	.....	.....	1.6	.....	600	8,000	2.00	52	8	.28
Beef calves	36 head	.....	.....	.....	.....	.....	.....	.....	Nursed	.....	18.00	302	36	1.44
Yearling heifers	8 head	.....	26	18	.....	.....	6.8	.....	.....	.....	9.60	67	8	.32
Fattening cattle	19,450 lb. gain*	1,476	.....	608	9,725	.....	20.4	.....	.....	.....	.....	467	133	3.89
Hogs	46,000 lb. gain†	2,290	267	891	3,300‡	3,374‡	.....	.....	.....	1,660	11.25	720	136	72.00
Chickens	80 hens	19	31	9	.....	.....	.....	.....	.....	240	.....	152	.....	8.00
Total		3,832	1,725	1,557	13,025	3,374	107.3	15.0	600	9,900	119.85	3,618	464	100.09

* Includes 4,275 pounds gain on nine purchased feeder calves.

† Includes 1,000 pounds gain behind feeder cattle for which no additional feed is provided. It is assumed that the use of alfalfa pasture will reduce the amount of grain and protein supplement by five per cent.

‡ Substituted for skim milk at the rate of one pound of linseed meal and tankage for ten pounds of skim milk.

A minor rotation of four fields of five acres each is suggested for providing hog pasture. A rotation of corn, oats, alfalfa, and alfalfa is suggested. It is anticipated that the spring pigs will be too small to utilize all of the alfalfa pasture early in the season and therefore one cutting of the alfalfa is indicated.

The suggested numbers and the production and disposition of livestock and livestock products are presented in table 28. Four milk-and-beef cows are retained to assure an ample supply of dairy products for home use. A beef-breeding herd of forty cows is added. Nine additional feeder calves are purchased in order to provide two full carloads of baby beeves for sale and still leave one animal for butchering and seven heifers for replacements. The production of hogs is increased to 30 spring litters and 10 fall litters. It is assumed that 1,000 pounds of gain will be obtained from the feed salvaged in the cattle-fattening lot.

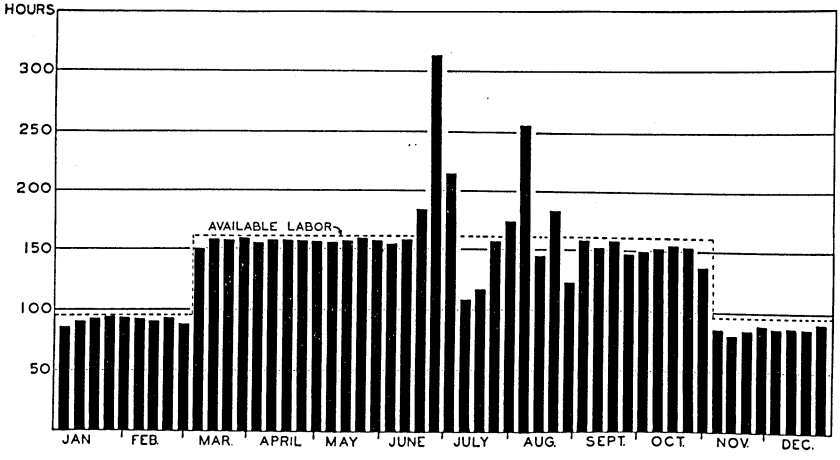

FIG. 11. DISTRIBUTION OF MAN LABOR BY WEEKS ON A FARM ADAPTED TO BABY-BEEF PRODUCTION WITH THE SUGGESTED ORGANIZATION

The suggested organization provides for complete utilization, practically speaking, of the available labor.

The estimated total amounts of feed, labor, and miscellaneous cash expenses used in the production of this amount of livestock are summarized in table 29. These amounts are based on the numbers and production of livestock indicated and the unit expenditures as given in table 24, except that it has been assumed that the use of alfalfa pasture for growing pigs would reduce the amount of grain and skim milk needed by as much as five per cent.

The distribution of man labor by weeks with the suggested organization is shown in figure 11. The suggested organization

Table 30. Normal Returns with Suggested Organization for Baby-Beef Production (Farm 2)

	Amount		Price		Value	
Crop sales						
Oats	320 bu.	at	$ .27	$ 86		
Total crop sales					$ 86	
Livestock and livestock product sales						
Butterfat	370 lb.	at	.27	100		
7 cows	7,700 lb.	at	.0375	289		
1 bull	1,500 lb.	at	.0375	56		
Baby beeves	37,100 lb.	at	.075	2,782		
Hogs	45,330 lb.	at	.065	2,946		
Eggs	179 doz.	at	.18	32		
Total livestock and livestock product receipts					6,205	
Total crop and livestock receipts						$6,291
Crop expenses						
Twine	320 lb.	at	.08	26		
Threshing				122		
Sweet-clover seed	882 lb.	at	.06	53		
Alfalfa seed	207 lb.	at	.20	41		
Total crop expenses					242	
Livestock and feed expenses						
1 bull				150		
9 beef calves	4,050 lb.	at	.06	243		
2 boars	300 lb.			50		
Veterinary, medicine, etc.				100		
Feed grinding	1,011 cwt.	at	.08	81		
Tankage	3,375 lb.	at	0.25	84		
Oilmeal	13,025 lb.	at	.018	234		
Total livestock and feed expense					942	
Other expenses						
Labor	8 mo.	at	30.00	240		
Labor	20 days	at	1.50	30		
Interest, depreciation, taxes, and insurance on extra buildings and equipment				105		
Interest on additional investment in cattle and hogs	1,900	at	5%	95		
Total other expense					470	
Total crop, livestock, and other expenses						1,654
Return above expenses which vary with changes in organization						4,637
Probable difference in returns in favor of suggested organization						$524

provides for almost complete utilization of the labor of the operator, family labor, and an additional worker hired for a period of eight months. In addition, it is estimated that approximately twenty days of extra day labor will be needed during hay and grain harvesting. The balance of the labor can be supplied by exchanging help with neighbors.

A summary of the sales and expenses that are affected by the change in organization is presented in table 30. Since the present

buildings are inadequate for housing the additional livestock, provision is made in the expenses for interest, depreciation, taxes, and insurance on an additional cattle shed 20 by 60 feet in size, and nine portable hog houses, each large enough to house two sows and their litters. An allowance for interest on an additional investment of $1,900 in cattle and hogs also is included.

After the expenses indicated are deducted from the sales, the return to the suggested organization amounts to $4,637. This gives the suggested organization an advantage over the old organization of approximately $524 annually.

After the suggested organization has been in use long enough to become thoroughly established, it may be expected that there will be some improvement, perhaps 10 per cent, in yields. This will provide the basis for further expansion in livestock production and therefore for an additional increase in returns.

Organizing the Farm for the Feeding of Purchased Cattle

There are numerous farms in southwestern Minnesota which have a small proportion of the farm acreage in nontillable land and a small amount of unpaid family labor. The amount of corn and other grains produced on such farms generally is large in relation to the production of hay and the amount of pasturage. The maintenance of fertility on such farms makes advisable the growing of legumes and the feeding of the major portion of the crops grown to livestock on the farm. The raising and fattening of beef cattle provide a means of utilizing to advantage a combination of large quantities of grain, hay, and pasturage, and a limited amount of labor. Purchased feeder cattle may be fat-

Table 31. Distribution of Acreage and the Production and Disposal of Crops (Present Organization, Farm 3)

Crop	Acres	Production			Disposal		
		Unit	Per acre	Total	Seed	Feed	Sales
Corn, husked	79	bu.	38	3,002	16	2,986	.....
Corn, fodder	23	ton	2.5	57.5	.....	57.5	.....
Oats	58	bu.	45	2,610	145	2,278	187
Barley	27	bu.	36	972	54	918	.....
Flax	15	bu.	13	195	12	.....	183
Alfalfa	10	ton	1.00	10.0*	.....	10.0	.....
Timothy and clover	7	ton	1.25	8.7	.....	8.7	.....
Pasture†	71	pasture					
Farmstead, road, etc.	22						
Total	312						

* Pastured.

† Rape sown with the oats and barley furnished additional pasture after the grain was harvested.

Table 32. Normal Amounts of Materials and Contract Services Used in Crop Production, Farm 3

Crop	Materials per Acre		Contract Services	
	Kind	Quantity	Kind	Cost
Corn, husked	Seed	.14 bu.		
Corn, fodder	Seed	.16 bu.		
	Twine	5 lb.		
Oats	Seed	2.5 bu.	Threshing, bu.	$.02½
	Twine	3.2 lb.		
Barley	Seed	2.0 bu.	Threshing, bu.	.04
	Twine	3.0 lb.		
Flax	Seed	.75 bu.	Threshing, bu.	.10
	Twine	2.8 lb.		
Alfalfa	Seed	10 lb.		
Sweet clover	Seed	12 lb.		
Clover and timothy	Seed (clover)	10 lb.		
	Seed (timothy)	8 lb.		

tened without the use of pasture, and therefore this is an enterprise that is well adapted to farms that have a limited amount of pasture.

Present Organization

The third farm (farm 3) selected for budgeting is one that is fairly representative of such farms as those discussed above. It is a 312-acre farm with all land tillable and with little unpaid family labor. The inventory of resources is as follows:

Inventory of Present Resources	Acres
Real estate	
Tillable crop and pasture land	290
Farmstead, road, and waste	22
Total	312
Labor supply	
The operator's labor for the entire year	
The assistance of the operator's wife in chores and caring for chickens	
One hired laborer for the entire year	
One hired laborer for seven and one-half months	
Power and equipment	
Eight work horses	
One 15-30 tractor	
All machinery needed for the crops grown	

The farm is amply equipped with buildings to care for the present production of livestock.

The acreage, production, and disposition of crops grown under the present organization are shown in table 31.

The normal amounts of materials and contract services used for crops grown on this farm are given in table 32.

The number, production, and disposal of livestock and livestock products are shown in table 33.

Table 33. Number, Production, and Disposal of Livestock and Livestock Products (Present Organization, Farm 3)

Class of livestock	Number	Production			Disposal		
		Kind	Unit	Amount	Fed to livestock	Used in home	Sold
Milk-and-beef cows	4 head	1 cull cow	lb.	1,100	.....	.....	1,100
		Butterfat	lb.	720	36	477	207
		Skim milk	lb.	11,350	11,350	.....	.....
Young cattle	5 head	3 baby beeves	lb.	2,700	.....	.....	2,700
Sheep	225 head	2 rams	lb.	300	.....	.....	300
		21 cull ewes	lb.	2,730	.....	.....	2,730
		100 market lambs	lb.	9,000	.....	.....	9,000
		Wool	lb.	1,480	.....	.....	1,480
Hogs	24 sows	Marketable hogs	lb.	43,800	.....	1,850	41,950
Chickens	150 hens	Chickens	lb.	1,200	.....	200	1,000
		Eggs	doz.	1,500	.....	330	1,170

The normal amounts of feed, labor, materials, and services used per head or per one hundred pounds gain in livestock production on this farm are presented in table 34.

A summary of the total amounts of feed, labor, and materials used in livestock production with the present organization is given in table 35.

The distribution of man labor by weeks with the present organization and the available labor supply on this farm are shown in figure 12.

A summary of the sales and expenses, including only those which are affected by changes in organization, is given in table 36. On the basis of the products available for sale as shown in tables 31 and 33 and the prices given in table 7, the annual return above the indicated expenses with the present organization amounts to $3,339.

Suggestions for Reorganization

A study of the organization and operation of this farm indicates that a number of changes might be made with resulting increase in the net returns.

All land is tillable on this farm and yet a considerable acreage is used for native pasture. The production of hay is insufficient to meet the needs of the present livestock. The proportion of the acreage in soil-building or legume crops is too small to maintain

fertility and crop yields. The amount and nature of the livestock enterprises are such as to provide for only partial utilization of the present labor supply during the winter months.

In view of these conditions and the available resources of this farm, a reorganization of both crop and livestock enterprises seems desirable. Since sweet clover and alfalfa yield so much more feed per acre either as hay or pasturage than native pasture, it seems advisable to include all land in the rotation and to use sweet clover and alfalfa for pasture. An increase in the acreage of legume hay is also desirable. This should make possible the raising of all roughage needed and also the improvement in live-

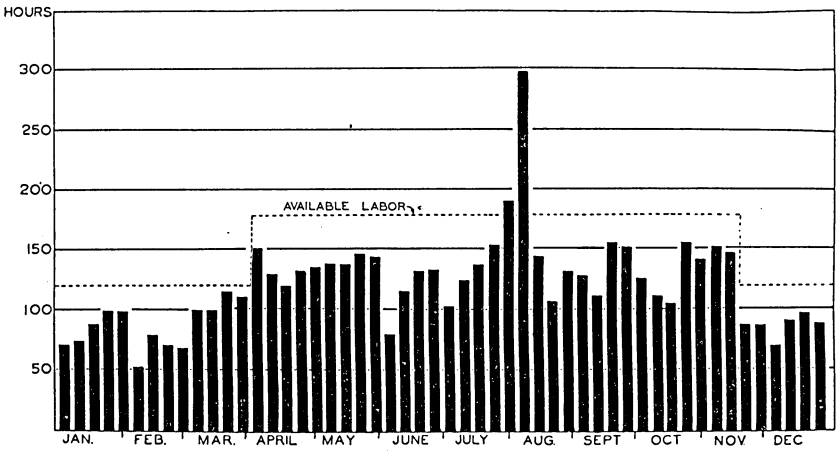

FIG. 12. DISTRIBUTION OF MAN LABOR BY WEEKS ON A FARM ADAPTED TO THE FEEDING OF PURCHASED CATTLE WITH THE PRESENT ORGANIZATION

The present organization fails by a rather wide margin to provide full employment for the available workers.

stock rations by replacing corn fodder with alfalfa. The distribution of acreage and the production and disposal of crops suggested to effect these changes in the cropping system are shown in table 37. The land is divided into a major rotation consisting of eight fields of 30 acres each and a minor rotation with five 10-acre fields. One of the eight fields in the major rotation would be used for alfalfa, three for corn, and one each for barley, oats, flax, and sweet-clover pasture. Flax has been a profitable cash crop on this farm, and it is retained in the present organization with an increase in acreage. Alfalfa would be allowed to remain on an individual field from three to five years, depending upon its condition. The minor rotation of five fields would be used for growing two fields of corn, one field of barley, and two fields of alfalfa. In the minor rotation, alfalfa would be grown on a field only two

Table 34. Normal Amounts of Feed, Labor, Materials, and Services Used in Livestock Production, Farm 3

Class of livestock	Unit	Corn	Oats	Barley	Linseed meal	Meat scrap	Tankage	Legume hay	Other hay	Corn fodder	Milk	Skim milk	Pasture*	Man labor	Horse work	Vet., med., salt, etc.
		pound	pound	pound	pound	pound	pound	pound	pound	pound	pound	pound	acre	hour	hour	dollar
Work horse	1 head	.....	3,200	.....	.....	.....	.....	1,000	2,100	1,400	.....	.....	.50	50.0	.....	.15
Cows																
Milk-and-beef	1 head	300	1,200	.....	.....	.....	.....	2,000	.....	2,000	.....	.....	.75	143.0	11.0	.25
Beef	1 head	.....	.....	.....	.....	.....	.....	1,500	.....	1,800	.....	.....	.75	21.0	3.5	.20
Bull	1 head	150	300	300	.....	.....	.....	1,000	.....	2,000	.....	.....	.75	30.0	2.5	.20
Young milk-and-beef cattle																
First year	1 head	100	300	.....	.....	.....	.....	300	.....	550	250	2,500	.25	22.0	3.0	.05
Second year	1 head	.....	200	.....	.....	.....	.....	800	.....	1,075	.....	.....	.75	16.0	2.0	.05
Calves to be fattened	1 head	.....	300	.....	.....	.....	.....	.....	.....	.....	250	2,500	.35	10.0	1.0	.05
Young beef cattle																
First year	1 head	.....	300	.....	.....	.....	.....	900	.....	.....	Nurse	.....	.25	16.0	2.0	.05
Second year	1 head	.....	200	.....	.....	.....	.....	1,000	.....	850	.....	.....	.75	16.0	2.0	.05
Young beef calves to be fattened	1 head	.....	.....	.....	.....	.....	.....	.....	.....	.....	Nurse	.....	.25	6.0	.8	.05
Fattening cattle (feed lot period)																
Yearlings	cwt. gain	600	.....	.....	55	.....	.....	350	.....	.....	.....	.....	.....	3.5	1.0	.05
Calves	cwt. gain	550	.....	.....	30	.....	.....	300	.....	.....	.....	.....	.....	3.5	1.0	.05
Sheep																
Breeding flock	1 head	.....	155	.....	5	.....	.....	40	.....	425	.....	.....	.10	2.0	1.0	.20
Ewe lamb	1 head	.....	100	.....	5	.....	.....	50	.....	400	.....	.....	.04	.5	.2	.05
Yearling ewe	1 head	.....	155	.....	5	.....	.....	40	.....	425	.....	.....	.10	1.0	.4	.20
Fattening lamb	1 head (25 lb. gain)	75	20	30	5	.....	.....	110	.....	10	.....	.....	.04	1.0	.4	.02
Hogs	cwt. gain	325	10	85	2	.....	3	.....	.....	.....	.....	.....	.03	1.3	.2	.12
Chickens	100 hens	3,450	2,200	2,454	.....	470	.....	.....	.....	.....	.....	900	.....	260.0	1.4	10.00

* Acreages are based on good sweet clover or alfalfa pasture. Where native pasture is used, the allowance is double that indicated.

Table 35. Amounts of Feed, Labor, Materials, and Services Used for Livestock Production (Present Organization, Farm 3)

Class of livestock	Number	Corn	Oats	Barley	Linseed meal	Meat scrap	Tankage	Legume hay	Other hay	Corn fodder	Milk	Skim milk	Pasture	Man labor	Horse work	Vet., med., salt, etc.
		bushel	bushel	bushel	pound	pound	pound	ton	ton	ton	pound	pound	acre	hour	hour	dollar
Work horses	8 head	.....	800	.....	.....	.....	.....	4.0	8.4	5.6	.....	.....	4.00	400	.....	1.20
Cows																
Milk-and-beef	4 head	21	150	.....	.....	.....	.....	4.0	.....	4.0	.....	.....	3.00	572	44	1.00
Calves																
Replacement	1 head	2	9	.....	.....	.....	.....	.3	.....	.2	250	2,500	.25	22	3	.05
For feeders	3 head	.....	28	.....	.....	.....	.....	.....	.....	.....	750	7,500	.75	30	3	.15
Yearling heifer, replacement	1 head	.....	7	.....	.....	.....	.....	.5	.....	.4	.....	.....	.75	16	2	.05
Baby beeves	3 head (1,500 lb. gain)	195	.....	.....	450	.....	.....	2.3	.....	.....	.....	.....	.....	52	30	.75
Sheep (mature)	145 head	.....	702	.....	725	.....	.....	2.9	.....	30.8	.....	.....	14.50	290	145	29.00
Lambs (replacement)	35 head	.....	109	.....	175	.....	.....	.9	.....	7.0	.....	.....	1.40	18	7	1.75
Yearling ewes (replacement)	35 head	.....	170	.....	175	.....	.....	.7	.....	8.5	.....	.....	3.50	35	14	7.00
Lambs (for sale)	100 head	134	63	63	500	.....	.....	5.5	.....	.5	.....	.....	4.00	100	40	2.00
Hogs	43,800 lb. gain	2,542	137	776	876	.....	1,314	.....	.....	.....	.....	.....	13.14	569	88	52.56
Chickens	150 hens	92	103	77	.....	705	.....	.....	.....	.....	.....	1,350	.....	390	2	15.00
Total		2,986	2,278	916	2,901	705	1,314	21.1	8.4	57.0	1,000	11,350	45.29	2,494	378	110.51

Table 36. Normal Returns with Present Organization (Farm 3)

	Amount	Price		Value	
Crop sales					
Oats	187 bu.	at $ .27	$ 50		
Flax	183 bu.	at 1.65	302		
Total crop sales				$ 352	
Livestock and livestock product sales					
1 cull cow	1,100 lb.	at .0375	41		
Butterfat	207 lb.	at .27	56		
3 baby beeves	2,700 lb.	at .075	203		
2 rams	2 head	at 15.00	30		
21 cull ewes	2,730 lb.	at .05	136		
100 market lambs	9,000 lb.	at .065	585		
Wool	1,480 lb.	at .25	370		
Hogs	41,950 lb.	at .065	2,727		
Chickens	1,000 lb.	at .10	100		
Eggs	1,170 doz.	at .18	211		
Total livestock and livestock product sales				4,459	
Total crop and livestock sales					$4,811
Crop expenses					
Rape seed	150 lb.	at .08	12		
Alfalfa seed	20 lb.	at .20	4		
Clover seed	70 lb.	at .20	14		
Timothy seed	56 lb.	at .07	4		
Twine	424 lb.	at .08	34		
Threshing			124		
Total crop expense				192	
Livestock and feed expenses					
Bull service			4		
Rams	2	at 25.00	50		
Boars	2	at 25.00	50		
Baby chicks	400	at .06	24		
Linseed meal	2,901 lb.	at .018	52		
Meat scrap	705 lb.	at .025	18		
Tankage	1,314 lb.	at .025	33		
Alfalfa hay	11 ton	at 10.00	110		
Veterinary, medicine, salt, etc.			111		
Feed grinding			105		
Total livestock expense				557	
Other expenses					
Labor			585		
Fuel and lubricants, tractor			138		
Total other expenses				723	
Total crop, livestock, and other expenses					1,472
Returns above expenses which vary with changes in organization					$ 3,339

Table 37. Distribution of Crop Acreage, Production, and Disposal of Crops (Suggested Organization, Farm 3)

Crop	Acres	Production			Disposal		
		Unit	Per acre	Total	Seed	Feed	Sales
Corn, husked	110	bu.	38	4,180	16	4,164	.....
Oats	30	bu.	45	1,350	75	1,275	.....
Barley	40	bu.	36	1,440	80	1,360	.....
Flax	30	bu.	13	390	23	.....	367
Alfalfa	35	ton	2.25	78.8	.....	78.8	.....
Alfalfa pasture	15	ton	1.00	15.0	.....	15.0	.....
Sweet clover	30	pasture					
Farmstead, road, etc.	22						
Total	312						

years in succession. The adoption of such a cropping system materially increases the total production of feed, provides sufficient legumes (when they are fed on the farm and the manure is returned to the land) to maintain fertility, and increases the proportion of feed relatively high in protein.

The utilization on the farm of the feed crops and pasture available with the suggested revision of the cropping system requires a change in livestock production. Beef cattle use larger amounts of grain and labor per unit of roughage than do sheep. The feeds produced with the suggested cropping system are better adapted to the needs of beef cattle than to those of sheep. It is suggested, therefore, that the sheep be disposed of and a beef-breeding herd of 19 cows and a bull be added to the livestock organization. It is further suggested that the calves not needed for replacement of the breeding herd, together with an additional 28 purchased feeder calves, be fattened for market as baby beeves. The beef-

Table 38. Number, Production, and Disposal of Livestock and Livestock Products (Suggested Organization, Farm 3)

Kind	Number	Production			Disposal		
		Kind	Unit	Amount	Fed to livestock	Used	Sold
Milk-and-beef cows	4 head	1 cull cow	lb.	1,100	.....	.....	1,100
		Butterfat	lb.	720	36	477	207
		Skim milk	lb.	11,350	11,350	.....	.....
Beef cows	19 head	3 cull cows	lb.	3,300	.....	.....	3,300
Bull	1 head	.....	.....	.....	.....	.....	750*
Fattening cattle	45 head†	Cattle	lb	39,375	.....	.....	39,375
Other cattle	25 head	.....	.....	.....	.....	.....	.....
Hogs	24 sows	Marketable hogs	lb.	43,800‡	.....	1,850	41,950
Chickens	150 hens	Chickens	lb.	1,200	.....	200	1,000
		Eggs	doz.	1,500	.....	330	1,170

* One bull sold every two years.

† Includes 28 head of purchased cattle.

‡ Includes 1,000 pounds gain from feed salvaged in the cattle yard.

breeding herd and the calves raised provide a means of utilizing surplus pasturage and the purchased feeder cattle utilize the grain and hay not needed by other livestock. Other livestock enterprises remain the same as at present.

The resulting numbers and production of livestock and livestock products are shown in table 38. The four milk-and-beef cows are retained to furnish dairy products for home use. The

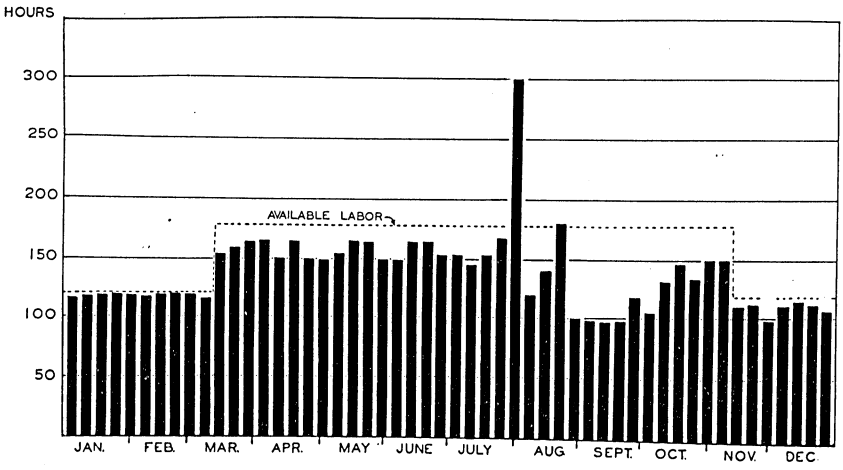

FIG. 13. DISTRIBUTION OF MAN LABOR BY WEEKS ON A FARM ADAPTED TO THE FEEDING OF PURCHASED CATTLE WITH THE SUGGESTED ORGANIZATION

The suggested organization provides for a more nearly complete utilization of the available labor.

calves that are raised would be put in the fattening lot at an average weight of about 425 pounds and sold as baby beeves at about 875 pounds. Feeder calves of comparable weight would be purchased and fattened.

The total amounts of feed, labor, materials, and services used in livestock production with the suggested organization are summarized in table 39. The suggested livestock organization makes full use of the feeds produced with the suggested cropping system.

The distribution of man labor by weeks with the suggested organization is shown in figure 13. The change in organization provides for a more nearly complete utilization of the available labor but does not require an increase in number of workers or in amount of hired labor. The only time at which the demand for labor exceeds the regular supply is during threshing when the excess is met by exchanging work with neighbors. The amount of labor used in the weeks following these peak periods appears low partly because of the omission from the chart of the time of the regular workers spent in returning exchange labor.

Table 39. Amounts of Feed, Labor, Materials, and Services in Livestock Production*
(Suggested Organization, Farm 3)

Class of livestock	Number of units	Corn	Oats	Barley	Linseed meal	Meat scrap	Tankage	Legume hay	Milk	Skim milk	Pasture	Man labor	Horse work	Vet., med., salt, etc.
		bushel	bushel	bushel	pound	pound	pound	ton	pound	pound	acre	hour	hour	dollar
Work horses	8 head	.....	800	.....	.....	.....	.....	17.4	.....	.....	4.00	400	.....	1.20
Cows														
Milk-and-beef	4 head	21	150	.....	.....	.....	.....	7.6	.....	.....	3.00	572	44	1.00
Beef	19 head	.....	.....	.....	.....	.....	.....	29.6	.....	.....	14.25	399	66	3.80
Bull	1 head	2	10	7	.....	.....	.....	1.4	.....	.....	.75	30	3	.20
Young cattle														
First year	4 head	7	38	.....	.....	.....	.....	1.6	1,000	10,000	1.00	88	12	.20
Second year	4 head	.....	25	.....	.....	.....	.....	3.5	.....	.....	3.00	64	8	.20
Calves (to fatten)	17 head (nursed)	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.25	102	14	.85
Fattening cattle	20,250 lb. gain	1,810	.....	221	5,200	.....	.....	30.4	.....	.....	.....	709	405	10.12
Hogs	42,800 lb. gain	2,232	149	1,055	856	.....	1,290	.....	.....	.....	12.90	556	86	51.36
Chickens	150 hens	92	103	77	.....	705	.....	.....	.....	1,350	.....	390	2	15.00
Total	.....	4,164	1,275	1,360	6,056	705	1,290	91.5	1,000	11,350	43.15	3,310	640	83.93

* Substitutions of one feed for another in order to utilize the feeds produced with the new organization was made on the same basis as in table 19. Nine pounds of alfalfa were used to replace ten pounds of corn fodder.

Table 40. Normal Returns with Suggested Organization for Feeding Purchased Cattle (Farm 3)

	Amount	Price	Value		
Crop sales					
Flax	367 bu.	at $ 1.65	$ 606		
Total crop sales				$ 606	
Livestock and livestock product sales					
Cull cows	4,400 lb.	at .0375	165		
Butterfat	207 lb.	at .27	56		
Bull	750 lb.	at .0375	28		
Fat cattle	39,375 lb.	at .075	2,953		
Hogs	41,950 lb.	at .065	2,727		
Chickens	1,000 lb.	at .10	100		
Eggs	1,170 doz.	at .18	211		
Total livestock and livestock product receipts				6,240	
Total crop and livestock receipts					$6,846
Crop expenses					
Alfalfa seed	200 lb.	at .20	40		
Sweet clover seed	720 lb.	at .06	43		
Twine	300 lb.	at .08	24		
Threshing			130		
Total crop expense				237	
Livestock and feed expenses					
1 bull every 2 years			75		
28 feeder calves	11,900 lb.	at .06	714		
Boars	2	at 25.00	50		
Baby chicks	400	at .06	24		
Linseed meal	6,056 lb.	at .018	109		
Meat scrap	705 lb.	at .025	18		
Tankage	1,290 lb.	at .025	32		
Feed grinding			93		
Veterinary, medicine, salt, etc.			84		
Total livestock and feed expense				1,199	
Other expenses					
Labor			630		
Fuel and lubricants for tractor			145		
Interest, depreciation, insurance, and taxes on additional investment in buildings, equipment, and livestock			110		
Total other expenses				885	
Total crop, livestock, and other expenses					2,321
Return above expenses which vary with changes in organization					4,525
Probable difference in returns in favor of suggested organization					$1,186

The estimated sales and expenses for the suggested organization are shown in table 40. A margin of one and one-half cents per pound between the purchase and sale prices of the purchased feeder cattle was assumed. A one-cent-per-pound change in the margin, considering the weight of the cattle bought, would result in a corresponding change of $119 in returns. Only the items affected by changes in organization are included.

The change in livestock production requires the addition of a cattle shed approximately 20 by 50 feet in size, the construction of additional bunks and feed racks, and an investment in additional cattle. It is estimated that the investment in additional cattle, buildings, and equipment will amount to approximately $2,650. Partially offsetting this increase is a reduction in investment of approximately $1,010 resulting from the elimination of sheep. The annual interest, depreciation, insurance, and taxes on the difference in investment is estimated at $110. This has been included as an expense in the financial summary for the suggested organization.

The suggested organization, according to the estimated sales and expenses, has an advantage in returns over the present organization of $1,186. It has a further advantage in that it should maintain present yields and may even lead to some increase in yields. If, when the suggested organization becomes thoroughly established, yields should be increased by five per cent, this should provide approximately $240 additional income with practically no additional cost other than the increase in labor needed in harvesting the larger yield.

BUDGETING ALTERNATIVE PROGRAMS

Plans for the reorganization of the farm business on each of three farms representative of conditions favorable to the different types of beef production were presented in the preceding discussion. These suggested reorganizations are not intended to be "ideal" organizations but rather to be organizations that illustrate the general nature of the adjustments which seem desirable. Other organizations might prove to be even more profitable. The material presented illustrates a method of determining the probable effects of anticipated changes in organization on net returns. The preparation of similar estimates of production, sales, and expenses for the different organizations which seem likely to be profitable provides a definite basis for the selection of the organization likely to prove most desirable under the given conditions.

APPLICABILITY OF SUGGESTED ORGANIZATIONS TO OTHER FARMS

The organizations suggested were developed to fit the conditions found on the particular farms. The advisability of their direct application to other farms is dependent on the similarity of resources and conditions on the farm in question to those on the farms discussed. Farms vary in size, proportion of land tillable, soil fertility, available buildings, machinery, power, and equipment, and farmers vary in ability and in preferences for

certain types of production. While it is unlikely that exactly the same conditions may be found on other farms, there probably are many farms to which such an organization, with some modifications, might be applied with a resulting gain in net returns. The material presented also may suggest to many farmers profitable changes in organization, which involve considerably less than a complete reorganization of the farm business.

SUMMARY AND CONCLUSIONS

Southwestern Minnesota has many characteristics favorable to the selection of beef cattle as a farm enterprise. The natural conditions of soil, topography, and climate have resulted in the growing of corn, oats, and barley on 60 per cent of the farm land. A relatively high proportion of the grains produced are corn and barley, which are essentially fattening grains. The proportion of the farm land used for tame hay is small. There are areas within practically every farm which because of uneven topography and poor drainage must be used for pasture or wild hay meadows. Incidental to the production of the grain and hay crops, there are produced additional quantities of cornstalks, straw, aftermath in meadows, and other rough feeds which must be converted into animal products to put them in marketable form.

Beef cattle are well adapted to the use of coarse roughages and large amounts of fattening grains in relation to the amounts of roughage and pasturage. Moreover, the system of beef-cattle management can be varied in accordance with the relationship between the labor supply and the feed supply. If the supply of labor is fairly generous, a milk-and-beef type of management may be used. If the supply of feed grains, particularly corn, is abundant in relation to the supply of labor, feeder cattle may be purchased and fattened. Many farmers in southwestern Minnesota find it to their advantage, therefore, to include the raising or fattening of beef cattle as a major part of their farm businesses.

Three fairly distinct systems of beef production, namely, baby-beef, milk-and-beef, and fattening of purchased cattle, have developed. On the baby-beef farms, a herd of 15 to 35 breeding cows is kept and the calves are allowed to nurse until they reach weaning age. Then these calves are fattened for slaughter as baby beeves weighing around 850 to 900 pounds. On the milk-and-beef farms, the herds usually vary from 5 to 25 cows. The cows are milked and the calves hand fed, largely on skim milk, until they are old enough to depend entirely on pasture or grain. The calves may be fattened as baby beeves or roughed through the winter and fattened as yearlings. The system of production in which purchased cattle are fattened is characterized by the purchase, usually in the fall, of thin feeder cattle, which are

fattened during the winter and early spring months. Frequently the raising of feeder cattle is a minor part of the beef-cattle enterprise on farms on which purchased cattle are fed.

A study of detailed records from a group of representative beef-cattle farms in Rock and Nobles counties and a general consideration of the organization and operation of other farms in the area indicate the need for certain readjustments if the most effective use of resources is to be obtained. The organization of the farm business frequently is not carefully and systematically planned, and therefore in many cases the adjustments are incomplete or misdirected. A close adherence to the system of beef-cattle production for which conditions at the farm are best suited would improve the present organization of many farms in southwestern Minnesota. The baby-beef system is a highly specialized line of beef-cattle production that is peculiarly adapted to farms with a plentiful supply of fattening feeds and sufficient pasture for summer maintenance of the breeding herd and nursing calves. A baby-beef herd provides the maximum utilization of a combination of concentrates, roughages, and pasture per unit of labor expended. A herd maintained under the milk-and-beef system of production uses less pasture but more labor proportionately to concentrates than does a baby-beef herd. On farms that are largely or wholly adapted to cultivation, the surplus of fattening grains can be used to advantage for fattening thin purchased feeder cattle. Profit in the fattening of purchased cattle, however, is dependent quite as much on the margin of selling price over purchasing price as on economical gains. Successful feeding of purchased cattle, therefore, requires considerable ability in judging the market and the value of thin cattle. Many beef-cattle farmers in southwestern Minnesota could grow more alfalfa hay with advantage. Alfalfa hay might well displace much of the corn fodder fed to milk-and-beef cows and to fattening cattle. Sweet clover or alfalfa pasture might well displace timothy or bluegrass pastures on tillable land. An increase in the use of alfalfa pasture for hogs also seems desirable on many farms. These changes are suggestive of the type of adjustments which should be given more consideration by farm operators.

The farmer who is interested in obtaining maximum utilization of his productive resources—land, available labor, equipment, and managerial capacity—should study his individual problem and decide when to make changes in his production program and the direction that such changes probably should take by acquiring a knowledge (1) of the possibilities of different lines of production under the conditions peculiar to his farm and with the degree of technical efficiency he and his helpers are capable of attaining, and (2) of the market situation for the various en-

terprises open to him for selection. He should prepare estimates of the comparative returns and variable costs involved in operating his farm with the production program adjusted to include the changes proposed, as opposed to continuing its operation without the respective changes. The comparative returns above variable costs will indicate the production program that appears most promising during the period into which he is projecting his plans.

The preparation of such estimates requires the use of data on physical yields of products that may normally be expected; amounts of labor, power, equipment, feed, and materials per unit of product that probably will be used; and a list of prospective prices. Such information should pertain to the individual farm. In the absence of more specialized data, however, the averages and standards presented in this bulletin will be useful as rough approximations.

The method of preparing such estimates of probable production, costs, and returns is illustrated by a discussion of the present organization and the desirable changes in organization for three of the farms studied. The steps outlined include the planning of the cropping system, the selection of livestock, the balancing of crop production against the feed requirements of the livestock, and the estimation of the effects of such changes on sales and expenses. While the suggested organizations may not be directly applicable to other farms, they indicate a method of properly evaluating the desirability, from the standpoint of net returns, of making contemplated changes in the farm business.

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APPENDIX

Table I. Factors of Cost for Livestock

	Range 1929-31				
	Low	High	Average	Standard	
Breeding herd					
Beef system				Nurse cow	Bull
Number of head per herd	19	33	26	20-30	.....
Calves raised per cow	.73	.96	.87	.88	.....
Per head:					
Grain, lb.	166	658	456		730
Hay and fodder, lb.	678	3,226	2,029	3,000	3,000
Silage, lb.	..... *	6,937	2,148	.....	.....
Pasture, days	191	248	228	1.5 acre	2.0 acre
Man labor, hr.	23	68	44	20	30
Horse work, hr.	2	9	5	3	2
Veterinary, medicine, etc., cts.	16	48	24	20	20
Milk-and-beef system				Milked cow	Bull
Number of head per herd	13	19	15	10-20	.....
Calves raised per cow	.53	1.04	.85	.90	.....
Butterfat per cow†	71	191	122	160	.....
Per head:					
Grain, lb.	346	2,799	1,446	1,000	730
Hay and fodder, lb.	1,072	3,766	2,587	3,750	3,000
Silage, lb.	.....	7,154	1,055	.....	.....
Pasture, days	191	256	236	1.5 acre	2.0 acre
Man labor, hr.	73	158	118	110	30
Horse work, hr.	2	10	7	4	2
Veterinary, medicine, etc., cts.	22	114	72	20	20
Young cattle					
Beef system				Heifer First year	Heifer Second year
Number of head per herd	12	27	20	.....	.....
Per head:					
Grain, lb.	43	534	388	300	200
Hay and fodder, lb.	25	994	396	725	1,600
Silage, lb.	.....	3,297	523	.....	.....
Pasture, days	164	237	196	.5 acre	1 acre
Man labor, hr.	9	16	11	8	8
Horse work, hr.	.5	4	2	1	1
Veterinary, medicine, etc., cts.	1	67	39	4	4
Milk-and-beef system					
Number of head per herd	12	39	23	.....	.....
Per head:					
Whole milk, lb.	.....	.....	.....	140	.....
Skim milk, lb.	.....	.....	.....	2,200	.....
Grain, lb.	287	1,066	867	375	200
Hay and fodder, lb.	247	990	844	725	1,600
Silage, lb.	.....	2,427	374	.....	.....
Pasture, days	159	241	194	.5 acre	1.2 acre
Man labor, hr.	10	24	15	12	8
Horse work, hr.	1	4	3	2	2
Veterinary, medicine, etc., cts.	17	43	32	7	7

Table I—Continued. Factors of Cost for Livestock

	Range			Standard		
	Low	High	Average	Calves	Yearlings	Two-year-olds
Fattening Cattle						
Production per farm, lb.	5,685	68,475	11,890	9,000	7,500	6,000
Length of feeding periods, days	.....	.....	.....	200-225	150-180	100-150
Gain per head per day, lb.	.....	.....	.....	2.20	2.40	2.60
Per 100 pounds gain in weight:						
Corn, lb.	415	960	856	525	600	700
Small grain, lb.	13	445	149	.....	.....	.....
Protein supplement, lb.	.....	38	23	60	75	90
Hay and fodder, lb.	105	745	289	200‡	250‡	325‡
Silage, lb.	.....	335	128	.....	.....	.....
Man labor, hr.	2.3	4.8	3.5	2.3	2.3	2.3
Horse work, hr.	.8	3.4	1.5	.7	.7	.7
Veterinary, medicine, etc., cts.	2	21	6	2	2	2
Sheep						
Number per flock	21	65	39		25-40	
Per head:						
Grain, lb.	.....	146	36		25	
Hay and fodder, lb.	14	352	133		250	
Silage, lb.	.....	252	56		.....	
Pasture, days	203	266	241		240	
Man labor, hr.	.8	4.5	3.1		1.8	
Horse work, hr.	.2	1.2	.6		.3	
Veterinary, medicine, shearing, etc., cts.	.2	63	24		20	
Fattening lambs, per head:						
Gain in weight, lb.	.....	.....	.....		25	
Grain, lb.	.....	.....	.....		100	
Protein supplement, lb.	.....	.....	.....		10	
Hay, lb.	.....	.....	.....		75	
Man labor, hr.	.....	.....	.....		.8	
Horse work, hr.	.....	.....	.....		.5	
Veterinary, medicine, etc., cts.	.....	.....	.....		2	
Swine						
Production per farm, lb.	11,913	76,295	31,619		30,000	
Pigs raised per litter	4.6	6.7	5.2		6.5	
Per 100 pounds gain in weight:						
Grain, lb.	358	550	495		400	
Skim milk or equivalent, lb.	32	244	117		150	
Pasture, days	8	45	27		25	
Man labor, hr.	1.2	3.3	2.2		1.5	
Horse work, hr.	.1	.7	.4		.3	
Veterinary, medicine, etc., cts.	3	50	21		15	

Table I—Continued. Factors of Cost for Livestock

	Range			
	Low	High	Average	Standard§
Chickens				
Number of hens per flock	39	247	131	160
Hens, per cent of flock	52	83	57	65
Eggs laid per hen	47	90	75	120
Meat produced per 100 hens	.....	1,287	630	900
Per 100 hens:				
Grain, lb.	2,067	9,522	6,254	7,800
Skim milk or equivalent, lb.	392	7,638	2,789	8,650
Man labor, hr.	143	398	241	250
Horse work, hr.	.....	14	5	5
Veterinary, medicine, etc., cts.	6	3,402	962	600
Work Horses				
Number per farm	5	13	9	9
Hours worked per horse	727	1,128	856	1,000
Per head:				
Grain, lb.	2,839	4,416	3,269	3,200
Hay and fodder, lb.	1,967	5,939	3,305	5,000
Pasture, days (including cornstalks)	34	168	148	120
Man labor, hr.	38	76	49	50
Veterinary, horseshoeing, etc., cts.	3	143	50	50

* Silage was produced on only 29 per cent of the farms studied.

† Exclusive of butterfat in whole milk received by calves.

‡ Legume hay.

§ The standard for poultry is based on the assumption that 200 pullets are transferred to the laying flock on October 1; that there will be a 20 per cent death loss; that approximately one-half of the hens will be culled and sold in June; and that the rest of the hens will be sold in September. The amount of feed allows for an average of 72 pounds of grain and the equivalent of 8 pounds of meat scraps per hen per year. Five hundred baby chicks would be necessary to provide the 200 pullets if a 20 per cent death loss is allowed and one-half the chicks are cockerels. It is assumed that the cockerels are sold when weighing from two to two and one-half pounds. The amount of feed allows 7 pounds of grain and the equivalent of 1 pound of meat scrap for each cockerel and 27 pounds of grain and the equivalent of 3 pounds of meat scrap for each pullet.

Table II. Amounts of Labor and Power Used per Acre for Crop Operations

Item	Range		Average		Standard	
	Man	Horse	Man	Horse	Man	Horse
Seedbed preparation						
Plowing: 4 horses	2.0 to 3.9	8.0 to 15.6	2.8	11.2	2.1	8.4
5 horses	1.8 to 2.7	9.0 to 13.5	2.3	11.5	2.0	10.0
6 horses	1.4 to 2.5	8.4 to 15.0	2.3	13.3	1.7	10.2
2-plow tractor	1.2 to 2.0	..... *	1.7	..... *	1.6	..... *
3-plow tractor	.8 to 1.5	..... *	1.2	..... *	1.0	..... *
Disking: 4 horses	.4 to .7	1.6 to 2.8	.5	2.0	.4	1.6
5 horses	.3 to .6	1.5 to 3.0	.5	2.2	.4	2.0
Harrowing: 4 horses	.2 to .4	.8 to 1.6	.2	1.0	.2	.8
6 horses	.2 to .3	1.2 to 1.8	.2	1.1	.2	1.2
Seeding and harvesting grain						
Drilling	.4 to .7	1.6 to 2.8	.5	2.0	.5	2.0
Broadcasting	.2 to .6	.4 to 1.2	.3	.7	.2	.4
Oats: Cutting	.5 to 1.1	2.0 to 4.4	.7	2.7	.6	2.4
Shocking	.6 to 1.9	.....	1.1	.....	.8	.....
Threshing	1.7 to 5.1	3.0 to 7.3	2.8	5.3	2.5	4.5
Barley: Cutting	.5 to 1.2	2.0 to 4.8	.8	3.0	.6	2.4
Shocking	.7 to 2.0	.....	1.2	.....	.9	.....
Threshing	2.0 to 4.9	4.0 to 9.8	2.9	5.4	2.4	4.7
Flax: Cutting	.5 to 1.5	2.0 to 6.0	.9	3.6	.7	2.8
Shocking	.7 to 1.5	.....	1.1	.....	.8	.....
Threshing	2.4 to 4.0	4.0 to 7.2	3.2	5.6	2.9	4.6
Planting and harvesting corn						
Planting	.5 to .9	1.0 to 1.8	.7	1.4	.6	1.2
Cultivating (2-row)	.7 to 1.0	2.8 to 4.0	.8	3.1	.8	3.2
Cutting	1.2 to 2.2	3.6 to 6.6	1.8	5.3	1.5	4.5
Shocking	1.4 to 6.0	.....	3.5	.....	2.5	.....
Filling silo†	4.5 to 11.0	6.5 to 16.1	8.1	11.9	7.8	12.7
Husking: Hand	4.4 to 8.0	8.8 to 16.0	6.1	11.1	4.7	9.4
Machine	3.7 to 6.4	11.0 to 15.8	4.2	12.9	3.7	11.4
Hay harvesting:						
Alfalfa (First cutting)						
Cutting	.7 to 1.8	1.4 to 3.6	1.2	2.4	1.0	2.0
Raking	.3 to 1.8	.6 to 3.6	.7	1.4	.5	1.0
Hauling to barn	1.8 to 6.1	2.0 to 7.3	3.4	5.0	2.3	3.1
Stacking	1.6 to 4.4	1.6 to 6.0	2.6	3.1	1.8	2.1
Alfalfa (Second cutting)						
Cutting	.6 to 1.6	1.2 to 3.2	1.1	2.1	.9	1.8
Raking	.3 to 1.3	.6 to 2.6	.7	1.3	.4	.8
Hauling to barn	.9 to 5.4	1.2 to 9.3	2.4	3.2	1.4	2.0
Stacking	1.3 to 4.4	1.7 to 7.5	2.1	2.5	1.5	2.1
Wild hay (1 cutting)						
Cutting	.7 to 1.7	1.4 to 3.4	1.3	2.6	1.0	2.0
Raking	.3 to 1.2	.6 to 2.4	.7	1.3	.9	1.8
Hauling to barn	1.2 to 4.7	1.6 to 7.1	3.0	4.4	2.0	2.8
Stacking	1.8 to 5.0	1.8 to 11.8	2.8	4.2	2.3	2.8

* Tractor hours are the same as the man hours.

† Average operating time for silo filler was .15 hour per ton.

Table III. Standards for Field Operations Performed with Horse Power in Rock and Nobles Counties

Corn Crops

Operation	Husked corn			Fodder corn			Silage corn		
	Times over	Hours per acre		Times over	Hours per acre		Times over	Hours per acre	
		Man	Horse		Man	Horse		Man	Horse
Plowing	1	1.7	10.2	1	1.7	10.2	1	1.7	10.2
Disking	1	.4	1.6	1	.4	1.6	1	.4	1.6
Harrowing	1	.2	.8	1	.2	.8	1	.2	.8
Planting	1	.6	1.2	1	.6	1.2	1	.6	1.2
Harrowing	1	.2	.8	1	.2	.8	1	.2	.8
Cultivating	4	3.2	12.8	4	3.2	12.8	4	3.2	12.8
Cutting	.....	.....	.....	1	1.5	4.5	1	1.5	4.5
Shocking	.....	.....	.....	1	2.5	.....	.....	.....	.....
Filling silo	.....	.....	.....	.....	.....	.....	1	7.8	12.7
Hand husking	1	4.7	9.4	.....	.....	.....	.....	.....	.....
Total	.....	11.0	36.8	.....	10.3	31.9	.....	15.6	44.6

Small Grains and Flax

Operation	Oats			Barley			Flax		
	Times over	Hours per acre		Times over	Hours per acre		Times over	Hours per acre	
		Man	Horse		Man	Horse		Man	Horse
Disking	2	.8	3.2	2	.8	3.2	2	.8	3.2
Seeding—broadcast	1	.2	.4	1	.2	.4	(1)	(.2)	(.4)
drill	(1)	(.5)	(2.0)	(1)	(.5)	(2.0)	1	.5	2.0
Harrowing	1	.2	.8	1	.2	.8	2	.4	1.6
Cutting	1	.6	2.4	1	.6	2.4	1	.7	2.8
Shocking	1	.8	.....	1	1.0	.....	1	.8	.....
Threshing*	1	2.5	4.5	1	2.4	4.7	1	2.9	4.6
Total	.....	5.1	11.3	.....	5.2	11.5	.....	6.1	14.2
Total†	.....	(5.4)	(13.3)	.....	(5.7)	(13.5)	.....	(5.8)	(12.6)

Hay Crops

Operation	Alfalfa (First Cutting) Hours per acre		Alfalfa (Second Cutting) Hours per acre		Wild Hay Hours per acre	
	Man	Horse	Man	Horse	Man	Horse
Cutting	1.0	2.0	.9	1.8	1.0	2.0
Raking	.5	1.0	.4	.8	.9	1.8
Putting in barn	2.3	3.1	1.4	2.0	2.0	2.8
Stacking	1.8	2.1	1.5	2.1	2.3	2.8
Total (barn)	3.8	6.1	2.7	4.6	3.9	6.6
Total (stack)	3.3	5.1	2.8	4.7	4.2	6.6

* Threshing hours for oats and barley include the hours hauling grain to the bin. The threshing hours on flax do not include hours for hauling to the bin or to market because most of the flax was trucked direct from the machine to market.

† Total if alternative method of seeding is used.

Table IV. Yield and Amounts of Seed, Twine, and Threshing Charges for Crops Grown

Crop	Yield per acre		Seed per acre		Twine per acre		Threshing charge, per bu.
	Average	Standard	Average	Standard	Average	Standard	
Corn:							
Husked	31.0 bu.	38.0 bu.	8.0 lb.	8.0 lb.	.....	.....	.....
Fodder	2.3 ton	2.5 ton	16.0 lb.	16.0 lb.	4.3 lb.	5.0 lb.	.....
Silage	6.2 ton	7.5 ton	16.0 lb.	16.0 lb.	4.0 lb.	5.0 lb.	.....
Oats:							
Drilled	46.0 bu.	45.0 bu.	3.7 bu.	2.0 bu.	3.1 lb.	3.2 lb.	$.02½
Broadcast	46.0 bu.	45.0 bu.	3.8 bu.	3.0 bu.	2.8 lb.	3.2 lb.	.02½
Barley:							
Drilled	31.0 bu.	36.0 bu.	2.1 bu.	2.0 bu.	3.0 lb.	3.0 lb.	.04
Broadcast	26.0 bu.	36.0 bu.	2.2 bu.	3.0 bu.	2.5 lb.	3.0 lb.	.04
Flax:							
Drilled	10.1 bu.	13.0 bu.	40.0 lb.	42.0 lb.	2.6 lb.*	2.8 lb.*	.10
Alfalfa	1.6 ton	2.25 ton	12.0 lb.	10.0 lb.	.....	.....	.....
Sweet clover	pastured	1.25 ton	10.0 lb.	12.0 lb.†	.....	.....	.....
Wild hay	1.0 ton	1.0 ton	.....	.....	.....	.....	.....

* Average for farms binding flax. On some of the farms the flax was not bound.
† If unscarified seed is sown, from 15 to 20 pounds should be used.

Table V. Periods for the Performance of Field Crop Operations

	Maximum*	Usual
Fall plowing	Aug. 7–Nov. 16	Aug. 15–Oct. 16
Oats		
Seedbed preparation and seeding	Mar. 17–May 4	Mar. 28–Apr. 20
Harvesting	July 7–Aug. 9	July 16–July 31
Threshing	July 21–Aug. 29	Aug. 3–Aug. 22
Barley		
Seedbed preparation and seeding	Mar. 17–May 9	Mar. 30–Apr. 23
Harvesting	July 7–July 31	July 12–July 27
Threshing	July 22–Aug. 25	Aug. 1–Aug. 22
Flax		
Seedbed preparation and seeding	Apr. 1–June 14	Apr. 14–May 4
Harvesting	July 21–Sept. 17	July 25–Aug. 12
Threshing	July 27–Oct. 17	Aug. 5–Sept. 2
Corn		
Seedbed preparation and planting	Mar. 21–June 21	Apr. 14–May 29
Cultivating	May 12–Aug. 5	May 19–July 19
Cutting and filling silo	Aug. 26–Sept. 23	Sept. 6–Sept. 18
Cutting and shocking	Aug. 1–Sept. 29	Sept. 1–Sept. 21
Husking	Sept. 2–Dec. 12	Sept. 21–Nov. 26
Alfalfa hay		
First cutting	June 6–July 15	June 17–July 7
Second cutting	July 22–Aug. 8	July 24–Aug. 17
Wild hay		
First cutting	June 22–Oct. 21	June 25–Sept. 14

* Earliest and latest date on which operation was reported.

Table VI. Percentage Distribution of Man Labor on Livestock, by Weeks, Beginning January 1

Week	Sheep	Swine		Poultry	Work horses	Milk-and-beef cows	Beef breeding herd	Fattening cattle	Other cattle	
		Spring litters only	Spring and fall litters						Milk-and-beef	Beef
1	1.9	1.9	2.2	1.7	1.2	2.0	1.9	3.2	2.1	2.3
2	1.8	2.0	2.2	1.7	1.2	2.0	2.1	3.3	2.1	2.3
3	2.8	2.1	2.1	1.7	1.3	2.1	2.1	3.3	2.1	2.5
4	2.7	2.0	1.9	1.7	1.3	2.1	2.1	3.0	2.1	2.6
5	2.3	2.0	1.7	1.6	1.3	2.1	2.1	3.3	2.1	2.6
6	1.7	2.0	1.9	1.6	1.3	2.1	2.2	3.4	2.2	2.4
7	1.6	2.0	2.1	1.7	1.4	2.0	2.2	3.4	2.3	2.4
8	1.5	1.9	1.8	1.7	1.2	2.0	2.2	2.9	2.3	2.4
9	2.4	1.8	2.1	1.8	1.6	2.2	2.4	2.0	2.4	2.9
10	3.7	1.8	2.6	1.8	1.7	2.2	2.4	2.2	2.5	2.9
11	4.3	1.8	2.6	1.9	1.6	2.2	2.3	2.0	2.4	2.9
12	4.8	1.8	2.6	2.0	1.8	2.2	2.3	2.0	2.4	2.9
13	5.7	1.8	2.5	2.1	2.0	2.2	2.3	2.7	2.4	2.9
14	3.8	1.9	2.3	2.4	2.3	2.1	2.2	2.6	2.4	2.7
15	3.4	1.9	2.2	2.3	2.3	2.1	2.2	2.5	2.4	2.6
16	2.7	2.0	2.2	2.5	2.5	2.0	2.2	2.5	2.4	2.4
17	2.7	2.0	2.1	2.5	2.7	2.0	2.2	2.5	2.4	2.1
18	1.8	2.1	2.1	2.8	2.6	1.9	2.2	2.6	2.0	2.1
19	3.1	2.1	2.0	2.8	2.7	1.9	2.1	2.2	1.9	2.0
20	4.7	2.2	1.9	2.7	2.7	1.8	2.1	2.1	1.9	1.9
21	2.8	2.1	1.8	2.6	2.8	1.9	1.9	2.0	1.7	1.4
22	2.2	2.1	2.1	2.5	2.5	1.9	1.9	2.0	1.6	1.3
23	2.1	2.1	2.0	2.4	2.6	2.0	1.9	1.9	1.7	1.3
24	2.9	2.1	1.8	2.4	2.6	1.9	1.8	1.6	2.1	1.3
25	1.3	2.0	1.7	2.3	2.5	1.9	1.8	1.6	1.6	1.3
26	1.0	2.0	1.5	2.2	2.4	1.9	1.8	1.5	1.6	1.3
27	.4	2.0	1.8	2.2	2.5	2.0	1.9	1.4	1.6	1.3
28	.2	2.1	1.9	2.0	2.4	2.0	1.9	1.2	1.3	1.3
29	.4	2.0	1.6	2.0	2.3	2.0	1.9	1.2	1.5	1.3
30	.....	2.0	1.6	2.0	2.1	1.9	1.9	.9	1.7	1.3
31	.....	1.9	1.5	1.9	2.1	1.8	1.9	.6	1.7	1.3
32	.2	1.9	1.8	1.8	1.9	1.8	1.9	.6	1.4	1.3
33	.6	1.9	1.8	1.8	1.9	1.9	1.9	.7	1.5	1.1
34	.9	1.9	1.7	1.8	1.9	1.9	1.8	.7	1.5	1.5
35	1.0	1.8	1.7	1.7	1.8	1.9	1.8	.8	1.6	1.5
36	.3	1.8	1.8	1.6	1.9	1.8	1.8	.5	1.6	1.8
37	.2	1.8	1.6	1.6	1.9	1.9	1.7	.6	1.7	1.7
38	.3	1.8	1.6	1.6	1.9	1.8	1.7	.7	1.9	1.7
39	1.0	1.8	1.6	1.6	2.0	1.8	1.7	.8	1.7	1.6
40	1.4	1.7	1.4	1.5	1.9	1.8	1.7	.7	1.6	1.4
41	1.3	1.7	1.4	1.5	1.9	1.7	1.6	.8	1.5	1.4
42	.1	1.6	1.4	1.5	1.9	1.7	1.6	1.1	1.6	1.2
43	.9	1.6	1.3	1.4	1.8	1.7	1.6	1.1	1.4	1.2
44	1.4	1.7	1.7	1.5	2.0	1.6	1.5	1.4	1.5	1.8
45	2.4	1.7	1.7	1.4	1.9	1.6	1.5	1.6	1.5	1.8
46	2.5	1.8	2.0	1.3	1.9	1.6	1.4	1.7	1.8	2.0
47	2.3	2.0	2.4	1.7	1.6	1.7	1.6	2.2	2.4	2.1
48	2.3	2.1	2.3	1.8	1.3	1.8	1.7	2.6	2.4	2.1
49	2.2	2.0	2.3	1.8	1.3	1.9	1.8	2.8	2.1	2.1
50	2.2	2.0	2.1	1.9	1.3	1.9	1.8	2.9	2.0	2.1
51	1.9	1.9	2.0	1.9	1.3	1.9	1.8	3.0	2.1	2.2
52	1.9	2.0	2.0	1.8	1.2	1.9	1.7	3.1	2.3	2.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table VII. Percentage Distribution of Man Labor on Crops by Weeks, Beginning January 1

Week	Husked corn	Oats	Barley	Flax	Corn fodder	Corn silage	Alfalfa	Wild hay	Hauling manure
1	.....	.....	.....	.....	.....	.....	.....	.....	2.0
2	.....	.....	.....	.....	.....	.....	.....	.....	2.1
3	.....	.....	.....	.....	.....	.....	.....	.....	2.2
4	.....	.....	.....	.....	.....	.....	.....	.....	2.4
5	.....	.....	.....	.....	.....	.....	.....	.....	2.4
6	.....	.....	.....	.....	.....	.....	.....	.....	2.4
7	.....	.....	.....	.....	.....	.....	.....	.....	2.5
8	.....	.....	.....	.....	.....	.....	.....	.....	2.5
9	.....	.....	.....	.....	.....	.....	.....	.....	2.5
10	.....	.....	.....	.....	.....	.....	.....	.....	3.2
11	.....	.....	.....	.....	.....	.....	.....	.....	4.0
12	.....	.6	.....	.....	.....	.....	.....	.....	3.4
13	.....	3.6	2.2	.....	.....	.....	.....	.....	2.3
14	.....	7.3	5.1	.....	.....	.....	.....	.....	1.6
15	1.2	12.6	10.7	9.8	1.3	.8	.....	.....	3.1
16	1.5	3.7	7.2	11.4	1.6	1.1	.....	.....	3.7
17	2.6	.....	.....	5.4	2.8	1.9	.....	.....	4.4
18	3.6	.....	.....	.....	3.8	2.5	.....	.....	2.2
19	6.4	.....	.....	.....	6.8	4.5	.....	.....	1.5
20	4.1	.....	.....	.....	4.4	2.9	.....	.....	1.1
21	1.4	.....	.....	.....	1.5	1.0	.....	.....	1.0
22	5.6	.....	.....	.....	5.9	3.9	.....	.....	.8
23	4.3	.....	.....	.....	4.6	3.0	.....	.....	.7
24	4.2	.....	.....	.....	4.5	3.0	2.0	.....	.5
25	4.1	.....	.....	.....	4.4	2.9	12.0	.....	.4
26	3.6	.....	.....	.....	3.9	2.6	29.9	2.1	.2
27	3.3	.....	.9	.....	3.5	2.3	14.6	4.8	.4
28	.6	9.1	15.2	.....	.7	.4	.....	6.7	.8
29	.....	19.6	15.0	.....	.....	.....	.....	16.4	1.6
30	.....	10.8	.....	12.9	.....	.....	1.5	10.4	1.7
31	.....	16.8	12.2	17.6	.....	.....	4.6	1.5	2.2
32	.....	12.6	13.4	14.4	.....	.....	16.8	4.2	2.4
33	2.7	3.3	18.1	11.5	2.9	1.9	10.0	4.3	3.5
34	2.7	.....	.....	7.0	2.9	1.9	8.6	8.9	3.5
35	2.7	.....	.....	10.0	11.7	1.9	.....	13.2	3.5
36	2.7	.....	.....	.....	15.8	25.0	.....	15.2	1.7
37	.....	.....	.....	.....	11.7	36.5	.....	12.3	2.1
38	.5	.....	.....	.....	5.3	.....	.....	.....	2.2
39	.5	.....	.....	.....	.....	.....	.....	.....	2.3
40	.9	.....	.....	.....	.....	.....	.....	.....	1.6
41	3.0	.....	.....	.....	.....	.....	.....	.....	1.0
42	6.6	.....	.....	.....	.....	.....	.....	.....	.4
43	7.2	.....	.....	.....	.....	.....	.....	.....	.5
44	10.9	.....	.....	.....	.....	.....	.....	.....	.8
45	8.0	.....	.....	.....	.....	.....	.....	.....	1.1
46	3.1	.....	.....	.....	.....	.....	.....	.....	1.0
47	2.0	.....	.....	.....	.....	.....	.....	.....	1.5
48	.....	.....	.....	.....	.....	.....	.....	.....	1.8
49	.....	.....	.....	.....	.....	.....	.....	.....	1.8
50	.....	.....	.....	.....	.....	.....	.....	.....	1.8
51	.....	.....	.....	.....	.....	.....	.....	.....	1.8
52	.....	.....	.....	.....	.....	.....	.....	.....	2.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table VIII. Percentage Distribution of Man Labor on Crops, Livestock, and Other Work, by Weeks, Beginning January 1

Week	Crops	Livestock	Other	Total
1	.3	2.0	1.5	1.3
2	.2	2.1	1.4	1.3
3	.2	2.2	.7	1.2
4	.2	2.3	1.2	1.3
5	.2	2.2	1.2	1.3
6	.5	2.0	1.7	1.4
7	.2	2.1	1.6	1.3
8	.4	2.1	2.2	1.5
9	.2	2.2	1.5	1.3
10	.4	2.6	1.7	1.6
11	.4	2.5	2.6	1.7
12	.5	2.4	2.2	1.7
13	.9	2.5	2.4	1.8
14	1.5	2.3	1.9	1.9
15	1.2	2.4	1.8	1.9
16	2.6	2.1	1.2	2.2
17	2.0	2.3	2.0	2.2
18	3.1	2.1	1.2	2.4
19	2.8	2.0	1.1	2.2
20	3.4	1.9	.9	2.4
21	2.3	2.1	2.8	2.3
22	1.4	2.0	3.3	2.0
23	3.2	1.9	1.4	2.3
24	2.2	2.0	3.1	2.2
25	3.0	1.9	2.0	2.4
26	3.4	1.8	1.7	2.4
27	2.2	2.0	2.3	2.1
28	3.3	1.9	1.9	2.5
29	2.8	1.9	3.5	2.4
30	3.9	1.8	1.9	2.6
31	4.2	1.7	1.8	2.7
32	3.1	1.7	1.7	2.2
33	5.0	1.6	1.2	2.8
34	3.4	1.6	1.1	2.2
35	2.0	1.7	2.5	1.9
36	2.1	1.5	2.7	1.9
37	2.3	1.6	2.6	2.0
38	3.5	1.5	2.3	2.4
39	1.7	1.6	3.1	1.8
40	2.1	1.4	3.2	1.9
41	1.1	1.5	3.8	1.6
42	3.2	1.4	1.4	2.1
43	4.1	1.3	1.4	2.4
44	1.7	1.6	1.9	1.7
45	4.1	1.3	1.2	2.4
46	3.8	1.5	1.7	2.4
47	1.2	1.8	2.1	1.6
48	1.1	1.8	1.7	1.5
49	.7	2.2	1.9	1.6
50	.3	2.0	2.5	1.4
51	.2	2.1	1.3	1.2
52	.2	2.0	1.0	1.2
Total	100.0	100.0	100.0	100.0

Table IX. Percentage Distribution of Horse Work on Crops, Livestock, and Other Work, by Weeks, Beginning January 1

Week	Crops	Livestock	Other	Total
1	.2	2.4	1.3	.3
2	.1	2.4	.8	.3
3	.1	2.1	1.8	.3
4	.1	4.2	1.9	.4
5	.1	2.6	1.3	.3
6	.4	2.1	1.5	.5
7	.2	2.0	.6	.3
8	.2	4.6	1.0	.5
9	.2	4.5	.6	.4
10	.3	3.6	1.1	.5
11	.2	4.0	2.2	.5
12	.3	4.4	1.5	.6
13	1.0	3.5	1.6	1.2
14	1.8	3.7	1.3	1.9
15	1.5	2.7	1.0	1.5
16	3.8	.8	.9	3.6
17	2.6	2.3	2.0	2.6
18	4.4	1.6	1.6	4.1
19	3.7	.8	1.2	3.4
20	4.8	1.1	1.4	4.5
21	3.4	1.7	4.2	3.3
22	1.6	1.1	4.3	1.7
23	4.1	.7	1.5	3.8
24	2.7	1.1	5.7	2.7
25	3.4	1.4	2.2	3.3
26	3.5	.3	2.3	3.4
27	2.4	.7	2.4	2.3
28	3.8	1.0	1.6	3.5
29	2.4	.6	4.0	2.3
30	2.6	.2	1.3	2.4
31	2.6	.4	.6	2.4
32	2.2	.2	.8	2.1
33	3.7	.5	2.1	3.4
34	2.7	.8	.7	2.5
35	1.9	1.6	3.4	1.9
36	2.0	.8	3.3	2.0
37	2.1	.9	.9	2.0
38	2.9	.7	3.7	2.8
39	1.5	.5	2.3	1.5
40	2.4	.6	3.2	2.3
41	.9	1.4	3.1	1.0
42	3.6	.8	1.1	3.3
43	3.9	.3	2.0	3.6
44	1.3	2.0	2.0	1.4
45	4.1	.9	1.1	3.8
46	3.4	2.1	2.4	3.3
47	1.0	3.2	2.8	1.2
48	.9	3.0	2.7	1.1
49	.5	5.1	2.5	.8
50	.2	3.0	2.5	.4
51	.1	4.0	.3	.4
52	.2	3.0	.4	.4
Total	100.0	100.0	100.0	100.0